REQUEST FOR PROPOSAL

40-FOOT LOW FLOOR DIESEL- ELECTRIC HYBRID TRANSIT BUSES
SECTION 1

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

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SECTION 1: NOTICE OF REQUEST FOR PROPOSALS

ISSUE DATE: June 11, 2015

NR 1. Request for Proposal No. 15-00086-AJFK - 40-Foot Diesel-Electric Hybrid Low-Floor Buses

The Southeastern Pennsylvania Transportation Authority (SEPTA) is soliciting proposals for the purchase of 40-Foot Low-Floor Diesel-Electric Hybrid Buses. Hence, for Price Proposal to be considered, pricing must be included for the 40-Foot Low-Floor Diesel-Electric Hybrid buses. SEPTA will evaluate each bus proposal in accordance with the criteria specified in Section 2 – Instructions to Proposers of the RFP and recommendation for award, if made, to the SEPTA Board of Directors will be for the proposal that provides the best value to SEPTA. The proposals submitted should be identified as Request for Proposal No. 15-00086-AJFK – 40-Foot Low-Floor, Diesel-Electric Hybrid Buses.

Proposers are advised that SEPTA is utilizing the Request for Proposal method for this Contract. This procedure affords all proposers the opportunity to submit requests for modifications to the Section 3 - Contract and General Conditions, other terms and provisions, and improvements to the Technical Specification.

NR 2. Proposal Submission

Each Proposal must be submitted in two (2) separate sealed parts, identified as the Technical Proposal and the Price Proposal. One (1) original and six (6) copies plus one (1) CD copy in PDF Format of the Technical Proposal and one (1) original and one (1) copy of the Price Proposal are to be submitted in writing to SEPTA by the close of business (4:30 PM) on Friday, August 7, 2015. Please direct all correspondence to:

Mr. John Kerrigan
Contract Administrator, Vehicles & Special Services
1234 Market Street, 11th Floor
Philadelphia, PA 19107-3780

See Section 2 – IP 4 for Proposal Security Requirements.

NR 3. Proposal Acceptance Period

The Proposal shall be binding upon the Proposer for one hundred and fifty (150) calendar days following the "Best and Final Offer". Any proposal on which the Proposer shortens the acceptance period will be rejected, although the acceptance period may be extended by mutual agreement between SEPTA and the Proposer.
NR 4. Pre-Proposal Meeting and Questions
A Pre-Proposal Meeting will be held on Monday, June 22, 2015 at 11:00 AM in SEPTA Conference Room 11A, located at 1234 Market Street, 11th Floor, Philadelphia, PA. A representative of your company should be present to discuss the proposed work with representatives of SEPTA.

All questions pertaining to this Request for Proposal must be submitted in writing to SEPTA - Procurement & Contracts Department, Attn: John Kerrigan, 1234 Market Street - 11th Floor, Philadelphia, PA 19107-3780 or email at jcoombs@septa.org. All questions must be received no later than the close of business (4:30 PM) on Tuesday, July 7, 2015.

Note: SEPTA will only accept questions from Bus Manufacturers.
SECTION 2

INSTRUCTION TO PROPOSERS
SECTION 2: INSTRUCTIONS TO PROPOSERS

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Southeastern Pennsylvania Transportation Authority

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SECTION 2: INSTRUCTIONS TO PROPOSERS

IP 1. General
You (hereinafter referred to as “Proposer”) are requested to submit a formal proposal (hereinafter referred to as “Proposal”) for the required Material and/or Equipment detailed in the Contract Documents (hereinafter referred to as “Project”) in accordance with this Request for Proposal (RFP). Any information in addition to that required by this RFP which Proposer feels will help in the evaluation of its Proposal is to be submitted with its Proposal. Any Proposal submitted must comply with the requirements of this RFP as herein stated including all applicable Federal, State and Local laws, and is to be signed by an officer legally authorized to bind Proposer to a Contract (hereinafter referred to as “Contract”) and shall be submitted to SEPTA in writing, in the time and in the manner described herein. Following is the RFP Quantity & Delivery Schedule:

<table>
<thead>
<tr>
<th>Calendar Year Delivery</th>
<th>Guaranteed Quantity</th>
<th>Non-Guaranteed Option Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>105</td>
<td>10</td>
</tr>
<tr>
<td>2018</td>
<td>100</td>
<td>15</td>
</tr>
<tr>
<td>2019</td>
<td>115</td>
<td>0</td>
</tr>
<tr>
<td>2020</td>
<td>115</td>
<td>0</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>525</strong></td>
<td><strong>25</strong></td>
</tr>
</tbody>
</table>

Configuration of the buses will be diesel-electric (Hybrid). The RFP requires that a Proposer must have the ability to manufacture 40’ Low-Floor Diesel-Electric Hybrid buses and in addition have the ability to handle the production schedule and production demands as stated in IP 1, above, and SP 2.

IP 2. Form of Proposal
Each Proposal shall be submitted in two (2) separate sealed envelopes/packages, one containing the Technical Proposal and one containing the Price Proposal. One (1) original and six (6) copies, plus one (1) CD PDF Format version of the Technical Proposal and one (1) original and one (1) copy of the Price Proposal, in sealed envelopes/packages which are identified on the face with the name of the Proposer and the Project name. This Bus Proposal must be identified as RFP No. 15-00086-AJFK.

IP 2.1 Technical Proposal Format
In a separate binder(s), each Proposer shall provide the following technical information. This binder shall contain alpha-numeric designated tabs, corresponding to the paragraphs and elements listed within IP 11 – Technical Proposal Format. The response to each paragraph should be contained within its respective tab. For example, the
Proposer’s documentation on how acceleration requirements will be met should be presented within Tab 11.1 (F). Each tab should include all information requested in its entirety and be fully self-contained, and not reference attachments distributed throughout the proposal. Each Technical Proposal shall demonstrate that all the equipment integrates and satisfies the functional requirements in the specification. General statements or overall descriptions may be used to supplement the material presented. If any exceptions to the Technical Specification are to be made, the Technical Proposal shall include a complete tabulation of every exception to the Technical Specification in the form of a compliance matrix.

The Technical Proposal should be clear and concise, and completely explain how the Proposer will meet the stated objectives. Brevity and clarity are desired. Statements merely indicating that the Proposer will meet specific requirements are not acceptable. The Technical Proposal will be judged on the completeness, clarity and technical content of the proposal as elaborated in IP 11 - Technical Proposal Format and IP 12 – Selection Process.

If more than one Hybrid bus power train is offered, the Proposer shall submit a separate and complete Technical Proposal (or separate and completely referenced Hybrid sections within one Technical Proposal) for each Hybrid power train being offered. The Proposer is responsible for duplicating the required submission forms and documents for each respective proposal.

The submission shall be made on 8.5 by 11 inch paper. A limited number of 11 by 17 inch fold-out drawings are permitted, other than the drawings specifically requested below. Supplier promotional brochures need not be included, unless pertinent technical information is provided by them. Drawings shall be of a print quality that is easily readable in English.

**IP 3. Obtaining Proposal Documents**
All required proposal forms are included with this RFP.

**IP 4. Proposal Security Requirements**
Proposers within the competitive range, who are invited to submit a Best And Final Offer (BAFO), must submit a Proposal Security in one of the following forms:
- Proposal Bond;
- Cashier’s Check;
- Certified Check;
- Treasurer’s Check; or
- Official Bank Check

(hereinafter called "Proposal Security"), along with the BAFO, in an amount of one million dollars ($1,000,000) and drawn in favor of the SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY.

The Proposal Security submitted by the proposers shall be retained by SEPTA for a period of ninety (90) days, or until a contract is awarded and entered into or all proposals are rejected, whichever comes first. SEPTA shall be entitled, but shall not have the obligation to cash Proposer's Proposal Security check and to invest the proceeds. The proposer, by submission of its proposal, consents to SEPTA's retention of any income generated by such Proposal Security.
Proposal Bond, if selected by proposer, must be issued by a fully qualified surety company acceptable to SEPTA and listed as a company currently authorized under 31 CFR Part 223 as possessing a Certificate of Authority as described thereunder.

**IP 4.1 Responsibility of Proposer**

SEPTA will only award a Contract to a firm which it has determined to be responsible. The Proposer shall furnish adequate documentation, as determined by SEPTA, within fifteen (15) days of receipt of SEPTA's written request to permit SEPTA to determine the responsibility of the Proposer. A responsible contractor is one which meets the following standards:

A. **Integrity and Ethics** - Has a satisfactory record of integrity and business ethics, in compliance with 49 U.S.C. section 5325(j) (2) (A);

B. **Debarment and Suspension** – Is neither debarred nor suspended from Federal programs under DOT regulations, “Nonprocurement Suspension and Debarment,” 2CFR Parts 180 and 1200, or under FAR at 48CFR Chapter 1 Part 9.4 or any Commonwealth of Pennsylvania funded programs;

C. **Affirmative Action and DBE** – Is in compliance with the Common Grant Rules’ affirmative action and DOTs’ Disadvantaged Business Enterprise requirements, 49 CFR part 26;

D. **Public Policy** – Is in compliance with the public policies of the Federal Government, as required by 49 U.S.C. Section 5325 (j) (2) (B) and Commonwealth of Pennsylvania public policies;

E. **Administrative and Technical Capacity** – has the necessary organization, experience, accounting, and operational controls and technical skills, or the ability to obtain them in compliance with 79 U.S.C Section 5325 (j) (2) (D);

F. **Licensing and Taxes** – Is in compliance with applicable licensing and tax laws and regulations;

G. **Financial Resources** – has, or can obtain, sufficient financial resources to perform the contract, as required by 49 U.S.C. Section 5325 (j) (2) (D);

H. **Production Capability** – Has, or can obtain, the necessary production, construction and technical equipment and facilities;

I. **Timeliness** – Is able to comply with the required delivery or performance schedule, taking into consideration all existing commercial and governmental business commitments; and,

J. **Performance Record** – Is able to provide a satisfactory current and past performance record.

**IP 4.2 Responsibility of Others**

**SEPTA:**

A. **PROJECT MANAGER**
SEPTA will provide a Project Manager (hereinafter referred to as "SEPTA's Project Manager") and management team which shall provide the technical direction of the Project. The SEPTA team shall also monitor and review the progress of the Proposer's services in order to aid in the program coordination. The participation by SEPTA's Project Manager shall not relieve the Proposer from its obligations under the terms of the Contract.

B. CONTRACT ADMINISTRATOR

SEPTA will also provide an administrator for the Contract (hereinafter referred to as "SEPTA's Contract Administrator"). All changes to contract requirements which need to be performed under the Contract must receive the prior written authorization of SEPTA's Contract Administrator.

IP 5. Submission of Proposals

One (1) original and six (6) copies of the Technical Proposal and one (1) original and one (1) copy of the Price Proposal, in sealed envelopes which are identified on the face with the name of the Proposer and the Project name, shall be submitted to:

Mr. James Coombs, Contract Administrator - Vehicles & Special Services  
SEPTA - Procurement and SCM Dept.  
1234 Market Street, 11th Floor  
Philadelphia, PA 19107-3780 USA

IP 5.1 Price Proposal

The Price Proposal shall be submitted to SEPTA as a separate sealed document. Price Proposals which exclude or restrict cost items necessary for a Proposer to perform the SEPTA required scope of services are not acceptable and may be considered by SEPTA as non-responsive to the RFP.

1. The Price Proposal shall be submitted on Appendix 2 - Price Proposal found in Section 11 - Appendixes, along with any other additional information required to make it complete.

2. The Price Proposal must include pricing for the Option as an element of responsiveness.

3. The requirements of the Contract included as Section 3 – Contract and General Conditions of this RFP should be carefully reviewed by the Proposer prior to preparation of its Price Proposal. In preparation of its Price Proposal, the Proposer must assume that SEPTA will not make any modifications to the terms of the Contract as attached.

IP 6. Other Information Included with Technical Proposal

If the Proposer is a joint venture, limited liability company, partnership, newly formed entity or holding company (Proposers Entity), then a copy of any written contract or understanding which exists between the members of the Proposers Entity shall be included as part the Technical Proposal. If no written contract or understanding exists, then the Proposer Entity shall include in its Technical Proposal a written statement explaining how the Proposer Entity will fulfill the requirements of the Contract included as Section 3 – Contract and General Conditions of this RFP. Such explanation shall fully discuss and identify the responsibility of the Proposer Entity for performing the services, providing the required insurance and bonding providing coverage for the indemnification of SEPTA.
required by the Contract. It shall clearly explain which parties of the Proposer Entity will interface with SEPTA on a design and technical basis, which major sections of the Technical Specifications will be handled by each party including post-delivery technical support and warranty, and which member of the Proposer Entity or partner will be responsible to resolve disputes between the Proposer Entity and SEPTA.

**IP 6.1 Certification Regarding Lobbying**
The Proposer shall submit a signed Certification Regarding Lobbying as set forth in Section 9 – Forms and Certifications, CER 1 of this RFP, and, if required by the terms of the Certification Regarding Lobbying, Standard Form - LLL, Disclosure of Lobbying Activities as set forth in Section 5 – Federal and State Requirements, FR 11 – Compliance with Federal Lobbying Policy.

**IP 6.2 Certification Regarding Debarment, Suspension, and Other Responsibility Matters**
(Lower Tier Covered Transactions. Instructions for Certifications)

**Suspension and Debarment**
This contract is a covered transaction for purposes of 49 CFR Part 29. As such, the Contractor is required to verify that none of the contractor, its principals, as defined at 49 CFR 29.995, or affiliates, as defined at 49 CFR 29.905, are excluded or disqualified as defined at 49 CFR 29.940 and 29.945.

The Contractor is required to comply with 49 CFR 29, Subpart C and must include the requirement to comply with 49 CFR 29, Subpart C in any lower tier covered transaction it enters into. By signing and submitting its proposal, the Proposer certifies as follows:

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

**IP 6.3 Buy America Provision**
This procurement is subject to the Federal Transit Administration (FTA) Buy America Requirements in 49 CFR Part 661 Section 165(b) (3) of the Surface Transportation Assistance Act of 1982, as amended. Each Proposer shall submit a signed copy of the "Buy America Certificate" with its proposal in accordance with the requirement of 49 CFR Part 666.13. (See Section 9 – Forms and Certifications, CER 2 - Buy America Certification).

A waiver from the Buy America Provision may be sought by SEPTA if grounds for the waiver exist. In order to qualify as a domestic end-product, the cost of components produced in the United States must exceed 60 percent, as defined in 49 CFR Part 661, of the cost of all components and subcomponents, and final assembly must take place in the United States.

The Proposer understands and agrees that, pursuant to 49 CFR Part 661.13, whether or not it certifies that it will comply with the applicable Buy America requirement, the Proposer is bound by its original certification or if given the opportunity, its certification submitted with its Best and Final Offer (BAFO), and is not permitted to change its certification after BAFO opening. In addition, if the Proposer certifies that it will comply with the
applicable Buy America requirements, the Proposer understands and agrees that it is not eligible for a waiver of those requirements.

**IP 6.4 Disadvantaged Business Enterprise (DBE)**
Participation Requirements: In connection with this solicitation and any resulting contract, the proposal shall be accompanied by a signed DBE Approval Certification (See Section 9 – Forms and Certifications, CER 3 - DBE Approval Certification).

**IP 6.5 Steel Products Procurement Act of 1978**
By submitting a proposal it specifically agrees to fully comply with the Commonwealth of Pennsylvania's Steel Product Procurement Act of 1978 (Act No. 3 of 1978, March 3 P.L. 6 (73 P.S. '1881 et seq.)), as amended.

The Commonwealth of Pennsylvania's Steel Product Procurement Act of 1978, as amended, defines "steel products" as products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more of such operations, from steel made in the United States of America by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process, and shall include cast iron products and shall include machinery and equipment listed in the United States Department of Commerce Standard Industrial Classification 25 (furniture and fixture), 35 (machinery, except electrical), and 37 (transportation equipment) and made of, fabricated from, or containing steel components. If a product contains both foreign and United States steel, such product shall be determined to be a United States steel product only if at least 75 percent of the cost of the articles, materials and supplies have been mined, produced or manufactured, as the case may be, in the United States. Transportation equipment shall be determined to be a United States steel product if it complies with 49 U.S.C. ' 5325(j) [formerly Section 165 of the Federal Surface Transportation Assistance Act of 1982, as amended] and the applicable regulations in 49 CFR Part 661.

The Proposer understands and agrees that, whether or not it sets forth any exceptions on its Price Proposal with the Steel Product Procurement Act, the Proposer is bound by its original Price Proposal and is not permitted to change its Price Proposal after proposal opening. In addition, if the Proposer does not set forth any exceptions with the Steel Product Procurement Act requirements, the Proposer understands and agrees that it is not eligible for a waiver of those requirements.

**IP 6.6 Certification of Compliance with Bus Testing Requirements**
Certifies that the vehicles offered in this procurement comply and will, when delivered, comply with 49 U.S.C. § 5323(c) and FTA's implementing regulation at 49 CFR Part 665. (Section 9 – Forms and Certifications, CER 5 - Certificate of Compliance with Bus Testing Requirement).

**IP 6.7 Certificate of Compliance with Immigration Reform and Control Act of 1986**

**IP 6.8 Federal Motor Vehicles Safety Standards Certificates**
See Section 9 – Forms and Certifications, CER 7 - Federal Motor Vehicles Safety Standards Certificates.
IP 7. Addenda
The contents of all addenda to Proposers are to be incorporated in the proposal and will become part of the contract documents. Addenda should be acknowledged on the Acknowledgement of Addenda Form (Section 9 – Forms and Certifications, CER 8) and included as part of the technical proposal.

IP 8. Disadvantaged Business Enterprise
SEPTA hereby notifies all Proposers that Disadvantaged Business Enterprises (DBE) will be afforded full opportunity to submit Proposals in response to this RFP and will not be subject to discrimination on the basis of race, color, sex, age, physical handicap or national origin in consideration for an award.

SEPTA solicits and encourages DBE participation as a prime Contractor, joint venture partner, and/or as a subcontractor for the Project. DBE's will be afforded full consideration and will not be subject to discrimination. All respondents will be required to comply with FTA's DBE requirements for bus manufacturers found in 49 CFR Part 26. (See Section 9 – Forms & Certifications, CER 3 – DBE Approval Certification)

IP 9. Rights Reserved By SEPTA
SEPTA expressly reserves the right to reject any and all Proposals and/or to negotiate separately with any firm in any manner deemed appropriate to serve its best interest. If an award is made as a result of the Proposals, SEPTA will award the Contract to the prospective contractor who SEPTA has determined to be responsible and responsive, and whose Proposal represents the “best value” to SEPTA by providing a combination of both price/cost and technical evaluation factors which SEPTA determines is in the best interests of and the most advantageous to SEPTA. SEPTA is not liable for any expenses incurred by any Proposer(s) in the development of its Proposal or any subsequent activity related to the Proposal.

Any Contract to be entered into pursuant to this RFP is subject to financial assistance grants between SEPTA, the United States Department of Transportation, Federal Transit Administration (FTA), and the Pennsylvania Department of Transportation, and must conform to the requirements thereof.

IP 9.1 Modifications to SEPTA’s Form of Contract
If an award of Contract is made as a result of this RFP, the proposed form of Contract which the Proposer will be required to execute is included in Section 3 – Contract and General Conditions of this RFP, and the Proposers are urged to review the Contract carefully. SEPTA may, at its sole discretion consider modifications to the terms of the proposed Contract, provided the Proposer specifically requests such modifications in its Technical Proposal. Any subsequent submission of modification request could result in rejection of proposal and/or cancellation of award.

The Contract requires that all tasks described in the RFP and/or Proposal shall be the Proposer's sole responsibility and shall be performed by the Proposer and its subcontractors/ sub-consultants. As part of the negotiation process (see IP 12 - Selection Process), SEPTA may elect to consolidate the services described in the RFP and the Proposal into a single document. The single document shall then become an Attachment to the Contract instead of the RFP and Proposal.

IP 9.2 Insurance
The Proposer shall be required to provide insurance as subject to the requirements of GC 11 - Risk of Section 3 – Contract and General Conditions.
IP 9.3 Performance Bond
The successful Proposer shall be required to furnish a Performance Bond not later than fifteen (15) days after Intent of Notice of Award, in accordance with the requirements of GC 12 – Performance Bond of Section 3 – Contract and General Conditions. The acceptable bond form is AIA Document A311.

IP 9.4 Additional Guarantee
SEPTA reserves the right, at its sole discretion, to require Proposer to provide additional guarantee from parent, affiliated or related corporation.

IP 9.5 Proposal Acceptance Period
The Proposal shall be binding upon the Proposer for one hundred and twenty (120) calendar days following the "Best and Final Offer". Any proposal on which the Proposer shortens the acceptance period will be rejected, although the acceptance period may be extended by mutual agreement between SEPTA and the Proposer.

IP 9.6 Taxes
1. Pennsylvania Sales and Use Tax: As an agency and instrumentality of the Commonwealth of Pennsylvania, SEPTA is exempt from the payment of Federal Excise Taxes and Pennsylvania Sales and Use Taxes (71 P.S. Sec. 7071 et seq.) on material, equipment or other personal property purchases and contracts for its exclusive use or consumption: therefore, the Proposer shall not include these taxes in the computation of its price proposal. SEPTA will furnish exemption certificates, as required, upon the request of the Proposer.

2. City of Philadelphia and School District of Philadelphia Taxes: The Proposer as a result of any contract entered into pursuant to this Request for Proposal, may be subject to certain business taxes imposed by the City of Philadelphia and/or the School District of Philadelphia. The Proposer is solely responsible for making its own investigation to determine whether or not it is subject to the above-mentioned city and school district taxes, and for paying any such tax if applicable. Proposers are hereby informed that SEPTA is obligated by law to furnish to the City of Philadelphia Department of Collections, upon its request, the name and address of any person or firm with whom it has a contract for goods and services. For information the following phone number is provided: Business and Earnings and School Income Tax (215) 686-6600.

IP 9.7 Performance Evaluation
SEPTA's Procurement Manual requires the formal performance evaluation of all Material/Equipment Contracts over $100,000. See Section 11 – Appendixes, Appendix 3.

IP 9.8 Buy America Pre-Award Audit for Rolling Stock
In compliance with 49 CFR Part 663, unless the Federal Transit Administration grants a waiver to the rolling stock to be purchased from the Buy America requirements, the successful Proposer will be required to provide SEPTA, or its designated independent third party reviewer, with sufficient documentation prior to contract award as to allow SEPTA, or its designated independent third party reviewer, to verify the accuracy of the Proposer’s Buy America Certification.

The documentation supplied by the Proposer must list (a) component and subcomponent parts of the rolling stock to be purchased identified by manufacturer of the parts, their country of origin and costs; and (b) 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.

SEPTA, or its designated independent third party reviewer, will also perform a post-delivery audit of the bus as actually manufactured in accordance with 49 CFR Part 663, and the Proposer shall supply sufficient documentation to verify compliance.

**IP 9.9 “Or Equal” Items**

Whenever in the Specification an article or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term "OR EQUAL" if not written thereafter shall be implied. Any reference to a particular manufacturer's product either by trade name or limited description is only for purposes of setting a standard of performance, quality, composition, construction or size.

The term "OR EQUAL" means any other manufactured product or article which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of SEPTA.

The Proposer shall furnish the “OR EQUAL” documentation for SEPTA’s review.

SEPTA's opinion as to whether the proposed alternate is "EQUAL" to the specified items for SEPTA's specified use and purposes shall be final and conclusive

**IP 9.10 Non-Collusion Requirement**

In the event Proposer is deemed the lowest responsive, responsible Proposer for this project, and as part of the proposal signed herewith, Proposer hereby agrees to sign an Affidavit of Non-Collusion in form acceptable to SEPTA prior to the award, if any, of the contract. A sample Affidavit of Non-Collusion is attached (Section 9 – Forms and Certifications, CER 4).

**IP 9.11 SEPTA Protest Procedures**

Protests relative to this procurement will be reviewed and adjudicated by SEPTA in accordance with SEPTA's Procurement manual (See Section 11 – Appendixes, Appendix 4).

SEPTA's Procurement Manual is available for inspection by Proposers in the offices of the Senior Director of Procurement - Procurement and Contracts Department, SEPTA, 1234 Market Street, 11th Floor, Philadelphia, Pennsylvania 19107-3780.

Since this procurement is receiving financial assistance from the Federal Transit Administration (FTA) and in the event all administrative remedies available under SEPTA's Bid Protest Procedures have been exhausted, the FTA will review protests under limited circumstances set forth in FTA Circular 4220.1F – Chapter VII, § 7.1 Protests.

(END OF PAGE)
IP 10. Technical Proposal Format

IP 10.1 Technical Approach

A. Bus Equipment Specification:
   Provide Section 11 - Appendix 1 - Design and Equipment Specification Form, completely filled out.

B. Passenger Capacity:
   1. Provide a seating layout delineating the number and type of seats that the bus can comfortably accommodate and include dimensions. The seating layout will be consistent with the Section 6 – Technical Specifications showing hip-to-knee and foot room dimensions. The layout(s) shall also indicate free floor space available to standees as defined in Technical Specifications - TS 2 and include the calculation of the free floor space.
   2. Provide a seat cross sectional drawing showing interior width, seat widths.
   3. Provide a vertical and horizontal stanchions system, placement and aisle widths.
   4. Provide details on total seated load and standee passenger load relative to GVWR of the vehicle.

C. Electrical System:
   1. Describe the proposed auxiliary electrical systems, BOM and system interoperability.
   2. Describe type and features of all network based systems.
   3. Describe vehicle network integration for IVS, including ASAS, CARD-AVL, APC and AVM systems. Provide all terms and system descriptions if proprietary system or term(s) are offered. Provide scope of work document which fully and completely describes the system, its operating physical layer and software elements required to obtain a complete and functional system as specified and clarified by Septa.

D. Technology Changes to Reduce Operating Costs and Improve Dependability:
   1. Provide documentation indicating any technology changes to improve maintenance and operations.

E. Propulsion System:
   1. Describe the proposed propulsion system and controls and provide detailed information on how the bus will meet the performance requirements specified.
   2. Provide integrated system propulsion and auxiliary support test documents specifying fuel economy goal.
   3. Describe the estimated fuel savings and greenhouse gas mitigation of this system and application as compared to a conventional T-Drive Diesel ICE drive train.

F. Braking Performance:
   1. Provide detailed description of architecture of the foundation brake system.
   2. Describe the dynamic braking effect as a means of maximizing foundation brake life and cost by application of efficient use of recuperative braking.

G. General Arrangement and Appearance:
   1. Provide drawings and other documentation necessary to fully describe the proposed bus including operator’s station with dashboard layout, left and front. Include sufficient information to show that interior and exterior aesthetic considerations have been carefully given to the design. Drawings are to include front, rear and side exterior elevation, roof equipment layout, passenger and operator interior layouts.
   2. Provide a roof equipment layout identifying equipment and weight of each unit.
3. Provide a list of all materials used in the construction of the bus firewall including fittings connectors, fasteners, insulation, screening, etc.

4. Provide the amount of time required for a technician to remove and replace a passenger window glazing.

5. Provide the amount of time required for a technician to remove and replace a passenger sacrificial liner.

H. Suitability to Operating Environment:
   1. Provide detailed description of vehicle structure and suspension including certification documentation of applicable vehicle durability testing and crashworthiness (Altoona & Bodycote).

I. ADA:
   1. Provides information that demonstrates that the interior design and appointments meet all engineering and operational aspects of the ADA regulations.

J. HVAC System:
   1. Describe the HVAC system, its capacity, performance and the measures that will be taken to integrate within the bus for the most efficient operation.

K. Environmental (Noise Control):
   1. Provide detail information as to how the interior and exterior noise specification requirements will be met. Include any acoustical treatment(s) that will be included to reduce dBA levels to meet specification criteria.

L. Ease of Ingress & Egress:
   1. Describe the considerations given in design to achieve ease of boarding, movement through the bus as well as ease of egress.

M. Energy Storage System (All submittals shall relate the gradeability, acceleration, fuel economy and battery life):
   1. Provide detailed descriptive information on the energy storage system proposed.
   2. Provide descriptive documentation supporting the type of energy storage component(s) selected including information on what factors were considered in determining specific energy, and energy density requirements.
   3. Provide documentation describing the life cycle cost of the energy storage system proposed.
   4. Describe the maintenance requirements necessary to achieve the optimum life of the energy storage system proposed and the required task frequency and resources.
   5. Provide information describing ESS accessibility including wiring, component(s) Racking System and ESS component weight(s).
   6. Describe the operating profile limiting ampere hour throughput rate for the ESS as applied to the transit bus system, include the general, most restrictive and least restrictive limiting case by operating profile, auxiliary features and applications.
   7. State the design life of the ESS and describe the statistical variations to ESS life.

N. Operating Efficiency:
   1. Provide documentation that demonstrates how the energy storage system and engine drive system is integrated to provide maximum fuel efficiency.

O. System Architecture for Accessories:
   1. Describe how accessories are driven (AC, PS/PB, Air Compressor, etc.)
   2. Provide detailed information supporting the benefits of the drive system proposed.
IP 11.2 Program Management/Manufacturing Approach

A. Manufacturing Plan:
1. Provide information that demonstrates the Proposer’s capability, capacity, and logistics to manufacture the bus in a timely manner. Include information on available plant capacity, personnel and other resources to perform the work.
2. Provide a project schedule showing key milestones. At a minimum it shall include award of major subcontracts, preproduction meeting(s), Pilot bus program, bus testing, start/completion of manufacturing, training and delivery of capital spare parts, training aids/mock-ups and manuals.
3. Provide organizational chart(s) showing management structure, various disciplines and interface among the disciplines for engineering, customer service, project management and manufacturing engineering, quality control and assurance and site manufacturing.

B. Engineering:
1. Describe the configuration control and process from design through production.
2. Describe how the Proposer documents, controls and implements changes to the design throughout the contract to prevent multiple iterations of the same part minimizing end user spare part inventory levels. See Section 3 – GC 9.4.

C. Warranty and After Market Support:
1. Provide information that demonstrates the quality and duration of the Proposer to warranty and follow-up support services.
2. Provide a copy of Proposer's Corporate Warranty Policy.
3. Specification Section 7 - Warranty Requirements: Provide comments, if any, or exceptions. If exceptions are taken the Proposer shall provide full justification in detail for each exception, and provide a recommended warranty period for said exceptions.
5. The Proposer shall provide a detail Logistics Plan description of the system that will be used for parts availability, capital and consumables, to support the Contract Warranty Program and after warranty period for the life of the bus.

D. Delivery:
1. Provide delivery schedules for the pilot bus.
2. Provide a tentative production schedule for each year of the contract.

IP 10.3 Test Training and Quality Assurance Approach

A. Testing, Training, and Quality Assurance Plans:
1. Provide information that demonstrates the Proposer’s commitment and capability to execute an effective testing and quality assurance program.
2. Describe how the Quality Assurance Program and established work procedures will be utilized to monitor and remedy as needed the quality of materials and workmanship in-house and by subcontractors.
3. Provide corporate applicable ISO Manufacturing and Process Control Certification(s).
4. Provide applicable AWS/CWS welder certifications, number of applicable employees and applicable tasks.

B. Publications & Training:
1. Describe the specification compliant training syllabus.
IP 10.4 Past Performance

A. Fleet Deployment Experience:
   1. Describe any vehicle system fleet defects that have been declared on a Proposer's bus of similar equipment as specified in the Section 6 – Technical Specifications or shown on the Design and Equipment Specification Form.
   2. Describe any National Highway Traffic Safety Administration (NHTSA) recalls on the Proposer’s bus and equipment shown on the Section 11 - Appendix 1.

B. Past Performance and Responsibility:
   1. List all bus contracts for the past 2 years, including customer, type of bus, brief description of the vehicle, quantity, major suppliers, contractual delivery schedule, and actual delivery schedule. List a contact person for each customer, including name, title, address and telephone number. Provide a sample of recommendation letter(s) from customers on support services after delivery, on workmanship and bus dependability.

IP 11. Selection Process

IP 11.1 Evaluation Criteria

A. The following technical evaluation criteria, listed in descending order of importance, will be used for the evaluation of Proposals according to SEPTA procedures:

1. Technical Approach
   
   This criterion considers the Proposer's approach toward the design of the Buses under this Contract and how the technical design approach meets the requirements of the Technical Specification. As set forth in IP 10.1 – Technical Approach, the criterion will be comprised of Tabs 1A through 1O of the Technical Proposal for the Hybrid bus configuration.

2. Program Management/Manufacturing Approach
   
   This criterion addresses the manufacturing capacity and logistics for the production of the proposed bus in a timely manner. Considerations include the overall approach to manufacturing and assembly of the bus, the approach to final assembly, the available plant capacity, personnel and other resources to perform the work. The Proposer's warranty system, methodology, warranty reimbursements rate for customer performed repairs, provisions and product support shall be described in this section. The criterion will be comprised of Tabs 2a thru 2d of the Technical Proposal as set forth in IP 10.2 - Program Management/Manufacturing Approach.

3. Testing, Training, and Quality Assurance Plan

   This criterion addresses the Proposer's commitment to, and execution of, a thorough, effective Bus testing, training and quality assurance program for this procurement. It considers the existence and role of quality assurance in the overall organization. The
procedures established to monitor and remedy the quality of materials and workmanship, both in house and by subcontractors. SEPTA will contact previous customers of the Proposer and major subcontractors to verify this information. The criterion will be comprised of Tabs 3a thru 3b of the Technical Proposal as set forth in IP 10.3 - Testing, Training, and Quality Assurance Plan.

4. Past Performance

Past performance considers the Proposer's and major subcontractor's performance in previous Bus procurement contracts. It addresses contractual issues, technical capability, quality of work, contractual delivery schedules, actual delivery schedules, Bus performance, reliability and maintenance. SEPTA will contact previous customers of the Proposer and major subcontractors to confirm this information. The criterion will be comprised of Tabs 4a thru 4b of the Technical Proposal as set forth in IP 10.4 - Past Performance.

B. Of the four technical evaluation factors above, factor (1) (technical approach) is the most important factor. Factor (4) (relevant experience/history and performance) is less important than factor (3) (Testing, Training, and Quality Assurance Plan). Factor (3) (Testing, Training, and Quality Assurance Plan) is less important than factor (2) (program management/manufacturing approach). When combined, factor (2), factor (3) and factor (4) are less important than factor (1).

C. SEPTA may conduct interviews and request and receive additional information from any as SEPTA deems necessary to properly evaluate the Proposals

D. Price is a factor in the overall evaluation. This factor considers what it will cost SEPTA to do business with a Proposer and the affordability of the proposed price. All of the technical evaluation factors, when combined, are approximately equal to price. Neither price/cost nor technical expertise shall be the sole determining factor. Accordingly, SEPTA may not necessarily make an award to the Proposer with the highest technical rating nor award to the Proposer with the lowest Price Proposal, if doing so would not be in the overall best interests of SEPTA, taking all of the factors into account. SEPTA, in its discretion, may determine that a higher-rated Technical Proposal may not justify SEPTA’s expenditure of the additional cost of the higher-rated Technical Proposal as opposed to a lower-priced Proposal, or may determine that although a Proposal may be the lowest price, the technical benefits of a higher-priced Proposal may be more advantageous to SEPTA, thus justifying the award to a higher-priced Proposal. As Proposals become more technically equivalent, price becomes more important, and conversely, as the price becomes more equivalent, the Technical Proposal becomes more important

IP 11.2 Evaluation and Selection Process

A. The standards and qualifications that follow have been developed to serve as positive indicators of expected performance or compliance with the requirements of the RFP. SEPTA will form a Technical Evaluation Committee comprised of senior managers of SEPTA or its agent to independently evaluate each Proposal on the technical evaluation criteria based upon the application of adjectival codes supported by narrative explanations. The narrative explanations
will identify the strengths, weaknesses (including deficiencies) of each Technical Proposal, as measured against the solicitation requirements and evaluation standards. The technical evaluation criteria will be evaluated as follows:

- **Excellent** - Significantly exceeds in all respects the specifications of the RFP; high probability of success; no significant weaknesses.
- **Very Good** - Substantial response: meets in all aspects and in some case exceeds, the specifications of the RFP; high probability of success; no significant weaknesses.
- **Acceptable** - Generally meets the specifications of the RFP; good probability of success; weaknesses can be readily corrected.
- **Marginal** - Lack of essential information; low probability of success; significant weaknesses, but correctable.
- **Unacceptable** - Fails to meet the specifications of the RFP; needs major revision to be acceptable.

These adjectival ratings are only guides to assist SEPTA in evaluating Proposals. They do not mandate the automatic selection or rejection of a particular Proposal or Proposer.

Proposals will be analyzed for conformance with the instructions and requirements of the RFP and contract documents. SEPTA reserves the right to request a Proposer to provide any missing information and/or to clarify any ambiguous or unclear matter.

The Technical Evaluation Committee will present its results to a Selection Committee composed of SEPTA executive staff members selected by the General Manager. The Price Proposals will not be opened until the Technical Evaluation Committee has concluded its technical evaluation of the Proposals and presented its results to the Selection Committee. The Technical Evaluation Committee will open the Price Proposals and brief the Selection Committee on their technical ratings and the original price proposal. The Selection Committee will determine which Proposals (if any) are within the competitive range as described in IP 11.2 (C), below. The Contract Administrator will make all decisions regarding the responsibility of Proposers. The Selection Committee in consultation with the Technical Evaluation Committee will also determine which Proposers will be invited for further discussions and negotiations, as described in IP 11.2 (D), below, and the recommended contract awardee, (if any), as described in IP 11.3 Award, below.

B. If, after all Proposals have been evaluated, only one Proposal (both the Technical Proposal and Price Proposal) is determined to be acceptable without further discussion and/or negotiation, SEPTA may elect to award the Contract to that Proposer.

C. However, if no Proposal is deemed to be acceptable without discussion and/or negotiation, those Proposers whose Proposals are determined by SEPTA to be within the competitive range will be contacted by SEPTA, in writing to formally schedule negotiations. Competitive range is determined by SEPTA and will be comprised of those Proposers who are determined to have a reasonable chance of being selected for award based on price as well as the technical evaluation factors. Proposers whose Proposals are determined by SEPTA not to be in the competitive range will be notified in writing. Notwithstanding the foregoing, SEPTA reserves the right to reject any and all Proposals, and to negotiate separately with any Proposer(s), if SEPTA determines that doing so would be in the best interests of SEPTA.
D. The Proposers whose Proposals are determined to be within the competitive range will be notified in writing. Each such Proposer may be invited to SEPTA’s offices to engage in negotiations and discussions of any facet of its Proposal.

E. No information, financial or otherwise, will be provided to any Proposer about any Proposals from other Proposers. Proposers will not be given a specific price or specific financial requirements which they must meet to gain further consideration, except that proposed prices may be considered too high with respect to the marketplace or unacceptable. Proposers will not be told of their ratings among the other Proposers.

F. After all negotiations and discussions have been completed, each of the Proposers within the competitive range with whom negotiations have been conducted will be afforded the opportunity to submit a BEST AND FINAL OFFER (including Option). The BAFO shall be each Proposer’s most favorable Price Proposal for the Technical Proposal and contractual terms which have been clarified and agreed upon during discussions and negotiations. The request for BAFOs will set forth the specific time and date for the submission of the BAFO. The BAFO (including Option) will be evaluated by SEPTA based upon which BAFO represents the “best value” to SEPTA by providing a combination of both price/cost and technical evaluation factors which SEPTA determines is in the best interests of, and the most advantageous to SEPTA.

IP 11.3 Award

A. SEPTA will make an award, if any, only to a Proposer who has been determined by SEPTA to be responsible and fully responsive to the RFP requirements, taking into consideration technical evaluations, discussions and negotiations, if conducted, and the BAFO (including Option), and whose Proposal represents the “Best Value” to SEPTA by providing a combination of both price/cost and technical evaluation factors that SEPTA determines is in the best interests of and the most advantageous to SEPTA. As stated above in IP 11.1 (Evaluation Criteria), SEPTA may not necessarily make an award to the Proposer with the highest technical rating nor award to the Proposer with the lowest Price Proposal, if doing so would not be in the overall best interests of SEPTA, taking all of the factors into account. SEPTA, in its discretion, may determine that a higher-rated Technical Proposer may not justify SEPTA’s expenditure of the additional cost of the higher-rated Technical Proposal as opposed to a lower-priced Proposal, or may determine that although a Proposal may be the lowest price, the technical benefits of a higher-priced Proposal may be more advantageous to SEPTA, thus justifying the award to a higher-priced Proposal. As Proposals become more technically equivalent, price becomes more important, and conversely, as the price becomes more equivalent, the Technical Proposal becomes more important.

B. The Selection Committee will make a recommendation to SEPTA’s Board of the Proposer who should receive the award of the Contract.
IP 12 Notice of Assignment

IP 12.1 Assignment of Transit Buses
FTA’s policy is that the original solicitation must contain an express notification to all bidders that an assignment would be possible under the terms of the contract. Such a notification would put the bidders on notice that they would likely be called upon to deliver all of the deliverable items, both the base as well as the option quantities. The assignment clause would thus be an important factor in the original competitive bidding. If the contract does not contain an express assignability clause, piggybacking is not permitted. See Section 3 – Contract and General Conditions, CG 28 – Assignability.

IP 14 SEPTA Bid/Proposal Protest Procedure
Proposal protests relative to this procurement will be reviewed and adjudicated by SEPTA in accordance with SEPTA Bid/Proposal Protest Procedure. See Appendix 4 – SEPTA Protest Procedures in RFP Section 11 – Appendixes.

(End of Section)
SECTION 3

CONTRACT AND GENERAL CONDITIONS
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SECTION 3: CONTRACT AND GENERAL CONDITIONS

GC 1. Contract
The Contract, entered into the ______ day of ________, 20____, by and between the Southeastern Pennsylvania Transportation Authority (hereinafter called "SEPTA"), a body corporate and politic exercising the powers of the Commonwealth of Pennsylvania, as an agency and instrumentality thereof, with offices located at 1234 Market Street, Philadelphia, Pennsylvania, and _____________________, (hereinafter called "Contractor"), a __________________________________ organized under the laws of ____________________________ with principal offices located at __________________________.

NOW, THEREFORE, in consideration of the mutual covenants herein contained, the parties hereto, intending to be legally bound hereby, agree as follows:

GC 1.1 Definitions
The following are definitions of special terms used in this document.

Best and Final Offer (BAFO) - The Cost Proposal made by a Proposer after negotiations are finished.


Contract Administrator - The SEPTA person who has contract administrative responsibilities for the Contract.

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

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

Due Date - The date and time by which proposals must be received by SEPTA as specified in "Instructions to Proposers".

Proposal - A written plan, if accepted, to deliver equipment and services according to the underlying Request for Proposals (RFP) of SEPTA documented using the prescribed form in the RFP, including any proposal or Best and Final Offer.

Proposer - The name or designation under which a company transacts business.

Procurement - A formal solicitation for goods, rolling stock or work.

Project Manager - The SEPTA person who is responsible for technical management of the project and is the main interface between the Contractor and SEPTA.

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

SEPTA - The Southeastern Pennsylvania Transportation Authority.
Solicitation - A formal request to an Offeror for a bid, request for qualification or a proposal (RFP).

Supplier or Subcontractor - Any manufacturer, company, or agency providing units, components, or subassemblies for inclusion in the Bus. Supplier items shall require qualification by type and acceptance tests in accordance with requirements defined in Section 8 - Quality Assurance Provisions.

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

GC 2. Contract and Modifications

GC 2.1 Contract Award and Execution
Contractor shall furnish, and if required by the Specifications install, the Material and/or Equipment described in the Specifications that are attached hereto and made a part of the Contract.

SEPTA shall pay to the Contractor, in consideration for furnishing the Material and/or Equipment in conformity with the Specification, the Firm Fixed Price(s) as set forth in the Price Proposal, attached hereto and made a part hereof as Appendix 2 – Price Proposal, in a total amount not to exceed $____________________ , excluding the optional buses, (hereinafter called "Contract Sum"). The Contract Sum shall be adjusted in accordance with Appendix 2 to the extent SEPTA purchases any of the non-guaranteed buses.

GC 2.2 The Contract
The Contract Documents form the Contract and represent the entire and integrated Contract between the parties and, except for substantial representations made by the Contractor upon which SEPTA was entitled to rely in making the decision to award the Contract to the Contractor, supersede all prior negotiations, representations, or Contracts, either written or oral. The Contract Documents which form the Contract consist of Sections 3 through 9, and Section 11.

GC 2.3 Order of Precedence
In the event of any conflicts among the Contract Documents, the Sections and requirements of the document which appears earliest in the listing shall govern.

1. Contract (Section 3 – Contract and General Conditions), including any amendment, modification or change order to the Contract mutually agreed to in writing and signed by proper officials of both parties;

2. Section 4 – Special Provisions;

3. Technical Specifications (Section 6);

4. Technical Proposal and any drawings;

5. Appendix 2 - Best and Final Offer (BAFO)

GC 2.4 Responsibility for Those Performing Work
The Contractor agrees that all personnel used in performance of the Contract shall be considered employees of the Contractor or its Subcontractors and in no event shall any of the personnel employed in the performance of the Contract be considered employees of SEPTA.
GC 2.5 Project Coordination
Contractor shall cooperate with SEPTA's Project Representatives, namely the Manager of Engineering - Buses of SEPTA, or his/her representative(s) designated in writing (hereinafter called "Project Manager"), who shall be responsible for technical direction provided by SEPTA, and the Contract Administrator of SEPTA, or his/her representative(s) designated in writing (hereinafter called "Contract Administrator"), who shall be responsible for the administration of the Contract on SEPTA's behalf.

GC 2.6 Contract Standard
The Specifications and Technical Proposal, including any addenda and modifications issued thereto, shall provide the standard for determining whether the Material and/or Equipment meets the Contract requirements.

Viewed individually and as a finished product, all material, components and parts installed in or on the Buses during its manufacture shall be newly made of the current model year under standard production by the manufacturer. Used, reconditioned or obsolete parts or components are not to be used in the assembly of the Buses or to be installed in or on it under any circumstances. Components or parts damaged prior to or during delivery are not acceptable and shall be replaced at the Contractor’s own expense with a new component or part. The Buses and all its components and parts shall be designed to permit ready accessibility for maintenance purposes with minimal disturbances of other components or parts. The term “heavy duty” where used in the Specification to describe a part or component shall be defined to mean “in excess of the usual or normal quantity, quality, or capacity that is supplied or manufactured.”

GC 2.7 Time of Performance
Contractor shall commence performance under the Contract within five (5) days of receipt of SEPTA's Notice to Proceed and shall fully complete performance of the Contract within the times specified in SP 2 – Project Schedule. All time limits contained in the Contract Documents are of the essence.

The Contractor shall coordinate and prepare, using input supplied by its Subcontractors, a schedule using the Critical Path Method (CPM) which shall show clearly the sequence of all Contract work representing the logic based schedule presented in the Technical Proposal. Each activity on the schedule shall be identified with a description of the work, and a duration in days for the performance of the activity. Activities should be identified in such a way so as to break down work tasks into categories not exceeding thirty (30) working days. Each activity shall be identified with the bid item under which payment shall be made, if applicable. The CPM schedule shall be subject to the prior approval of the Project Manager. The Contractor shall submit to the Project Manager, one (1) electronic updated schedule each month. Such updated schedules shall have completed activities removed or otherwise noted - as such. Whenever changes to the Project are authorized which add or delete activities and/or revise time for performance of existing activities and/or revised sequence of operation, they shall be reflected in the next updated schedule.

The Contractor shall furnish the initial complete Contract schedule for approval by SEPTA's Project Manager within thirty (30) days of receipt of SEPTA's Notice to Proceed. SEPTA will perform and forward a completed review within thirty (30) days.

GC 2.8 Changes
Any proposed change in this Contract shall be submitted to SEPTA in writing for its prior approval. Oral Change Orders are NOT permitted.
GC 2.9 Change Orders
SEPTA, without invalidating the Contract, may order changes within the general scope of the Contract consisting of additions, deletions, or other revisions, with the Firm Fixed Price(s) set forth in Appendix 2 and the Contract time of performance being adjusted accordingly. All such changes shall be authorized by written change order issued by the Contract Administrator and shall be executed under the applicable conditions of the Contract Documents.

It is understood and agreed that refinement or detailing will be accomplished from time to time with respect to the Specifications. No adjustments in the Firm Fixed Price(s) set forth in Appendix 2 or the Contract time shall be made unless such refinement or detailing results in changes in the scope, quality, function and/or intent of the Specifications not reasonably inferable or foreseeable by the Contractor.

GC 2.9.1 Written Change Orders

Definitions
1. A "Change Order" is a written order to the Contractor, signed by the Contract Administrator, issued in accordance with SEPTA's standard procedures and, authorized either by its General Manager or by its Board, as appropriate, after the execution of the Contract, which makes a change in the Work or an adjustment in the Contract Sum or the Contract time. A Change Order shall also be signed by the Contractor if it agrees to the adjustment in the Contract Sum or the Contract time. The Contract Sum and the Contract time may be changed only by Change Order. A sample copy of the Change Order form that will be utilized by SEPTA is attached to this Contract.

2. "Material", as used in this Paragraph GC 2.9, means an item or items provided by:
   a. a factory or established facility that produces on its premises the item(s) obtained by the Contractor; or
   b. a firm that owns, operates, or maintains a store, warehouse, or other established facility in which the item(s) required for the performance of the Contract is brought, kept in stock, and regularly sold to the public in the usual course of business.

3. "Subcontractor", as used in this Paragraph GC 2.9, means a firm providing labor or services necessary to complete a distinct element of the work. The labor or services provided must be substantiated on the basis of direct labor hours at specified fixed hourly rates.

4. "Equipment", as used in this Paragraph GC 2.9, means apparatus used by the Contractor or a Subcontractor to complete a distinct element of the work.

GC 2.9.2 Change Order Procedure
As soon as reasonably possible but no later than 30 (thirty) calendar days after receipt of the written Contract Change Order Forms to modify the Contract, the Contractor shall submit to the Contract Administrator 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 SEPTA. At that time a detailed modification shall be executed in writing by both parties. Disagreements that cannot be resolved with negotiations shall be resolved in accordance with the Contract disputes clause. Regardless of any disputes, the Contractor shall proceed with the work ordered.
GC 2.9.3 Changes and Amendments to the Contract
No Change Order or amendment to the Contract shall be binding unless executed in writing by SEPTA, in a form approved by SEPTA and concurred in by the appropriate governmental funding agencies, if required. SEPTA will obtain all required concurrences from governmental funding agencies.

All Change Orders or amendments to the Contract by SEPTA shall be transmitted to the Contractor through the Contract Administrator.

The provisions of the Contract relating generally to the Material and/or Equipment and its installation and performance shall apply without exception to any Material and/or Equipment, authorized by Change Order and to the installation and performance thereof, except as may be otherwise provided by written agreement between the Contractor and SEPTA.

GC 2.9.4 Price Adjustment for Contract Changes
If price adjustment is indicated, either upward or downward, it shall be negotiated between SEPTA and the Contractor, including changes that are mandatory as a result of legislation or regulations that are promulgated and become effective after the Due Date. Such price adjustment may be audited, where required.

GC 2.9.4.1 Determination of Cost/Credit
The cost or credit to SEPTA resulting from a change in the Material and/or Equipment shall be determined in one or more of the following ways:

1. **Unit Prices**
   a. If changes in the Material and/or Equipment are ordered by SEPTA and such Change Order calls for the deletion or addition of items of Material and/or Equipment and/or installation thereof of the same type as those for which unit prices have been stated in the Contract Documents or subsequently agreed upon, the amount to be paid or credited shall be computed on the basis of such unit prices.
   b. If unit prices are stated in the Contract Documents or are subsequently agreed upon, and if the quantities of changed Material and/or Equipment proposed will create a hardship on SEPTA or the Contractor, the applicable unit prices shall be equitably adjusted to prevent such hardship.
   c. Where in the sole opinion of SEPTA the application of unit prices would not be appropriate, the cost or credit to SEPTA shall be determined under the terms and conditions set forth in either item 2 or 3 in GC 2.9.4.1 as determined appropriate by SEPTA.

2. **Fixed Price Lump Sum Amount**
   Where SEPTA determines that the scope and extent of the change can be defined before the changed work is performed, and compensation is not computed on the basis of unit prices as set forth in GC 2.9.4.1 above, SEPTA may negotiate, based on direct and indirect cost elements, a fixed price lump sum amount with the Contractor as compensation for such work. The Contractor's price for changed Material and/or Equipment shall follow the guidelines set forth below:
   a. Labor
      (1) Actual Wages - base hourly rate for all levels but excluding premium pay paid to all employees directly engaged in the changed work.
(2) Labor Burden - to be established as a percent of actual wages paid pursuant to contractual obligation or corporate policy and shall include: Vacation Allowance, Health and Welfare, Pension, Apprenticeship Programs and other programs as required for each craft, Social Security, Unemployment Insurance and Worker's Compensation Insurance.

(3) Premium Time - Actual premium costs paid, plus paid social security taxes, unemployment insurance, workers' compensation insurance, and fringe benefits if required by contractual obligation or corporate policy.

(4) Overhead - In addition to Labor Burden, overhead could include additional indirect costs associated with manufacture and assembly. Any and all overhead will be subject to review and approval by SEPTA. In addition, overhead cost elements will be limited to GC 2.9.4.3 – Allowability and Allocability of Costs.

(5) Profit - Maximum ten (10) percent of the sum of subparagraphs (1), (2), (3) and (4) above. The negotiated Profit will be based on risk.

b. Material

(1) All materials incorporated into the final product of the Material and/or Equipment at the Contractor's net cost. Expendable materials, e.g., small tools and welding supplies, and reusable materials are not eligible for direct reimbursement, but are included in item 2.a. above.

(2) Actual freight and transportation costs of materials used.

(3) Material Overhead (if applicable) – Any and all overhead costs will be subject to review and approval by SEPTA. In addition, overhead cost limited to GC 2.9.4.3 – Allowability and Allocability of Costs.

(4) Profit: A negotiated maximum of four (4%) percent profit on items (1), (2) and (3), above.

c. Subcontractor Cost

(1) Subcontractor Cost - Shall be quoted in the manner prescribed above for the Contractor.

(2) Contractor's Overhead and Profit on Subcontractor Work - maximum five (5%) percent (combined overhead and profit) of the net amount of Subcontractor's cost of change.

3. Time and Material

Compensation for changed work on a time and material basis will be used only where SEPTA in its sole judgment determines that the scope and extent including cost of the work required cannot be readily determined or negotiated before the changed work is performed. Compensation due the Contractor for such changed work shall
be determined by post audit of the Contractor's supporting documentation, priced in accordance with GC 2.9.4.1.(2), above.

In the event SEPTA determines to compensate the Contractor for an item of changed work on a time and material basis, the Contractor shall, at the end of each day or at such other intervals as SEPTA shall direct in writing, furnish to SEPTA for such work, (a) daily time slips showing the name of each employee on such Material and/or Equipment, the number of hours which he or she was employed thereon, the character of his or her duties, and the wages paid to him or her, (b) a memorandum showing the rates and amounts of Workers' Compensation Insurance premiums and state and federal taxes based on such wages, (c) a memorandum showing vacation allowances, union dues and assessments and health, welfare, employment and retirement benefits which the employer actually pays pursuant to contractual obligation upon the basis of such wages, (d) a memorandum showing the amount and character of the materials furnished in the performance of the changed work, apparatus rented in connection therewith, from whom they were purchased or rented, and the amount paid therefor, and (e) a memorandum detailing payments made to approved subcontractors (with copies of subcontractor invoices attached supported by backup detailed in items (a) through (d) of this paragraph). The failure of the Contractor to furnish time slips and memoranda with respect to any particular labor, equipment, materials, apparatus or subcontract in the timely manner as specified shall constitute a conclusive and binding determination on its part that such labor, equipment, materials, apparatus or subcontract work is not changed work, and shall constitute a waiver by the Contractor of its claim for payment based thereon.

**GC 2.9.4.2 Access**
Representatives of SEPTA shall have access during normal business hours to all records and documents of the Contractor relating to any labor, materials, apparatus, plant and equipment, and overhead, used in the performance of changed work, and the Contractor shall obtain for them similar access to the records and documents of its Suppliers and Subcontractors. Such access shall be given or obtained both before and after completion of the changed work.

**GC 2.9.4.3 Allowability and Allocability of Costs**
Wherever a determination of cost is to be made, and such determination is not otherwise limited by the foregoing guidelines, the provisions of Subpart 31.2 et seq. of the Federal Acquisition Regulations, shall be used to determine the allowability and allocability of such costs, except that (those regulations notwithstanding) state and local taxes on net income shall not be allowed.

**GC 2.9.4.4 Other Requirements**
In all cases, the costs and percentages detailed in this Section GC 2.9.4 will cover any and all costs and profit not specifically mentioned therein. The sum of these costs with the applicable percentages will be the only costs used to determine the Contract price increase or decrease.

**GC 2.9.4.5 Prior Notice Required as Express Condition for any Claims for Additional Cost**
If the Contractor wishes to make any claim for any increase in the Firm Fixed Price(s) set forth in Appendix 2, it must give the Project Manager, with a copy submitted to the Contract Administrator, written notice thereof within ten (10) days after the occurrence of the event giving rise to such claim or it shall not be entitled to any compensation therefor. This notice must be given by the Contractor before proceeding to execute any of the changed work, except in an emergency endangering life or property, in which case the Contractor shall act to prevent threatened damage, injury or loss, providing that SEPTA is notified at the earliest opportunity. No claim
for any increase in the Firm Fixed Price(s) set forth in Appendix 2 shall be valid unless so made. To be considered for any additional money such claim must set forth the factual basis of the claim in sufficient detail for the party receiving it to know and understand, the nature, amount and extent of the claim and the event or events and fact or facts upon which the claim is based. The parties hereto agree that in the event of such claim or claims that they shall not proceed to litigation without first giving such notice and making reasonable efforts thereafter to resolve the claim or claims without the necessity of seeking recourse in the courts. The Contractor expressly agrees that it shall not make any claim, nor be entitled to any additional cost, against SEPTA resulting from the actions of any Subcontractor or other and separate contractors on the Project, it being clearly understood that the Contractor's sole avenue of recovery is against such Subcontractor or other and separate contractors on the Project.

Contractor agrees that failure to comply with the above, may result in waiver of its right, if any, to additional compensation.

**GC 3. Parties and Changes in Parties**

**GC 3.1 Parties**
The parties to the contract are SEPTA as defined in “Definitions”, GC 1.1 and the Contractor as set out in the accepted Proposal.

**GC 3.2 Succession**
The Contract will be binding on the parties, their successors, and assigns.

**GC 3.3 Assignment and Subcontracting**

**GC 3.3.1 Assignment of Rights: Delegation of Duties**
A. Contractor shall not sell, assign, transfer, or dispose of any interest in the Contract without the prior written consent of SEPTA thereto. SEPTA shall not be obligated to give such consent.

B. Contractor shall not delegate any duty to be performed under the Contract without prior written consent of SEPTA thereto. SEPTA shall not be obligated to give such consent.

C. Any attempt by Contractor to make such assignment or delegation prior to obtaining SEPTA's written consent shall give SEPTA the right to terminate the Contract with no further obligation to Contractor or anyone to whom the Contractor has attempted to assign, transfer, or delegate rights or obligations under the Contract.

**GC 3.3.2 Subcontracts**

**Definition**
1. A Subcontractor is an individual or organization who enters into a Contract with the Contractor to furnish labor or materials or apparatus in connection with the Material and/or Equipment directly or indirectly for or on behalf of the Contractor and whether or not in privity of Contract with the Contractor.

   The term “Subcontractor” is referred to throughout the Contract documents as if singular in number and neutral in gender and means a Subcontractor or its authorized representative.

2. Nothing contained in the Contract Documents shall create any contractual relationship between SEPTA and any Subcontractor.
Award of Subcontracts

1. Any new or additional or substituted Subcontractor proposed to be used by Contractor after the award shall be subject to SEPTA’s prior written approval. No increase in the Firm Fixed Price(s) set forth in Appendix 2 shall be allowed for any such substitution, however, SEPTA reserves the right to request a reduction in the Contract Sum for approving any requested substitution.

2. The Contractor shall not make any substitution for any Subcontractor or for any person or for any organization which has been previously accepted by SEPTA as part of the Contract unless and until requested to do so by SEPTA and/or unless such substitution is expressly approved by SEPTA in writing.

3. Within ten (10) days of receipt of written request from the Project Manager the Contractor shall furnish to SEPTA copies of all contracts between Contractor and any Subcontractor for the Material and/or Equipment.

Subcontractor Relations

The Contractor shall deal with each Subcontractor according to the terms and conditions of a written agreement between the Contractor and such Subcontractor. Said written agreement shall not be inconsistent with any term or condition of the Contract, shall include all terms and conditions required by the Contract and shall in every respect protect SEPTA’s interests in the work and conduct thereof.

In the absence of good and sufficient reasons, within twenty (20) days of the receipt of payment from SEPTA by the Contractor, the Contractor shall pay each Subcontractor with whom it has contracted, their earned share of the payment the Contractor received.

In addition, the Contractor shall pay its Subcontractors any retainage the Contractor has withheld from its Subcontractors within twenty (20) days after a Subcontractor’s work is satisfactory completed.

With regard to any claim or dispute with respect to payment of a Subcontractor or Supplier at any tier, Contractor expressly agrees to defend, indemnify and hold SEPTA, its officers, agents, servants, and employees harmless in the event any suit is brought on account of a dispute between any of the parties including but not limited to Subcontractors, Suppliers and material men and in particular, the Contractor shall assume the defense affirmatively at its sole cost whenever such suit is brought in any jurisdiction.

GC 4. Specification and Proposal Omissions

Notwithstanding the provision of drawings, technical specifications, or other data by SEPTA, the Contractor shall have the responsibility of supplying all parts and details required to make the Material and/or Equipment complete and ready for service even though such parts and details may not be specifically mentioned in the drawings and specifications. Items that are installed by SEPTA shall not be the responsibility of the Contractor.

GC 4.1 Termination of Contract

GC 4.1.1 Termination For Convenience

SEPTA shall have the right to terminate the Contract, in whole or in part, at any time by written notice to the Contractor. The Contractor shall be paid all reasonable costs as determined by SEPTA in accordance with 48 CFR Subpart 31.2, that specifies the special treatment of certain costs under Subpart 31.2, Section 31.205-42, “Termination Costs.”
Such costs will include contract work performed up to the date of termination; any actual costs associated with termination for convenience, as agreed to by SEPTA; and profit on Work performed up to the time of termination. Furthermore, SEPTA will not pay any anticipatory profits and/or consequential damages claimed by the Contractor as a result of termination of the Contract. The amount of profit paid shall be determined by the parties based on the risk of the amount of actual work completed. The Contractor shall submit promptly its termination claim to SEPTA and SEPTA shall determine the settlement amount to be paid the Contractor. If the Contractor has any property in its possession belonging to SEPTA, the Contractor shall account for same and dispose of it in the manner SEPTA directs.

**GC 4.1.2 Termination For Cause**

**A.** If Contractor fails to remedy or fails to submit a plan to remedy to SEPTA's satisfaction the breach or default of any of the terms, covenants, or conditions of the Contract within ten (10) days after receipt by Contractor of written notice from SEPTA setting forth the nature of said breach or default and/or if the Contractor is suspended or debarred by any federal agency or by the Commonwealth of Pennsylvania, SEPTA shall have the right to terminate the Contract without any further obligation to Contractor. Any such termination for cause shall not in any way operate to preclude SEPTA from also pursuing all available remedies against Contractor and its sureties for said breach or default.

**B.** In the event that SEPTA elects to waive its remedies for any breach by Contractor of any covenant, term or condition of the Contract, such waiver by SEPTA shall not limit SEPTA's remedies for any succeeding breach of that or of any other term, covenant, or condition of the Contract.

**C.** In the event that it is ultimately determined by SEPTA that the Contractor was not in default or that the failure to perform arose out of causes beyond the control and without fault of the Contractor, the termination shall be treated as one of convenience and the Contractor's sole rights and exclusive remedies shall be those set forth in GC 4.1.1, above.

**GC 4.2 Disputes**

**In General -** The parties to this Contract hereby authorize and agree that the resolution of all disputes, including claims arising under GC 2.9, under this Contract shall be resolved in accordance with this GC 4.2. Contractor and SEPTA agree that participation in each preceding step is a condition precedent to SEPTA’s or Contractor’s right to pursue any and all unresolved disputes to the next step of the dispute resolution process.

SEPTA and Contractor agree that all requests for additional compensation or an extension of time claims shall, in the first instance, be submitted in accordance with GC 2.9. If any such additional compensation or time extension claims have not been resolved by written agreement of SEPTA and Contractor within ninety (90) days of submission, such claim may be considered a dispute subject to the dispute resolution process outlined in distinct steps below; provided, however, that SEPTA may extend such ninety (90) day period by an additional period of time not to exceed thirty (30) days by giving Contractor written notice of such extension.

4.2.1: **Step 1 – Project Staff Level.** SEPTA’s Director of Contract Administration or his designee and an authorized representative of Contractor shall attempt to resolve the dispute. Any resolution of the dispute must be pursuant to a written agreement signed by both Parties and if applicable, incorporated into a Change Order. If SEPTA’s Director of Contract Administration or his designee and an authorized representative of Contractor cannot reach written agreement within thirty (30) days, then the Parties shall proceed to Step 2 of the dispute resolution process.
4.2.2: **Step 2** – Dispute Resolution Board. Any dispute that has not been resolved at the Project Staff Level explained in 4.2.1 above shall be subject to binding arbitration by the Dispute Resolution Board. The Dispute Resolution Board (“Dispute Resolution Board”) will consist of three (3) members, (i) an authorized representative of SEPTA’s Senior Director, Procurement and Supply Chain Management, (ii) an authorized representative of the Contractor, and (iii) an independent representative (“Independent Representative”). SEPTA and Contractor shall each propose three (3) names of persons to act as the Independent Representative to create a list of six (6) names. SEPTA’s authorized representative on the Dispute Resolution Board and Contractor’s authorized representative on the Dispute Resolution Board shall agree upon the Independent Representative from the list of six (6) names. Should the Parties fail to agree on the Independent Representative, SEPTA’s Senior Director of Supply Chain Management will make the final selection. The costs for the services of the Dispute Resolution Board will be shared equally by SEPTA and the Contractor.

All disputes subject to resolution by the Dispute Resolution Board shall be initiated through a written notice by each Party to the Independent Representative, with copies to SEPTA’s Senior Director of Procurement and Supply Chain Management and the authorized representative of the Contractor, within fifteen (15) days of the expiration of the thirty (30) day period provided in 4.2.1 above. Such notice shall state clearly and in full detail the specific issues of the dispute to be considered by the Dispute Resolution Board.

4.2.3: Within thirty (30) days after the submission of such notice, the Party initiating the dispute resolution process must provide the Independent Representative for distribution to the Dispute Resolution Board with all materials and other pertinent information in support of the Party's position or claim. Within thirty (30) days from the date of the written notice, the Party against whom the dispute was filed shall submit any and all materials and other pertinent information to the Independent Representative for distribution to the Dispute Resolution Board. The Independent Representative shall have the discretion to extend the time for submittals required hereunder.

4.2.4: The Dispute Resolution Board shall decide when to conduct a hearing and shall advise the Parties of the date, time and location for such hearing. During the hearing, the Contractor and SEPTA shall each have reasonable opportunity to be heard and to offer evidence. The Dispute Resolution Board upon notice to the Parties may seek such technical or other expertise as the Dispute Resolution Board shall deem necessary or appropriate and may seek any such additional oral or written argument or materials from either or both Parties as it deems fit. If so requested by any Party, the Dispute Resolution Board shall permit any Subcontractor whose Work is at issue to participate in the hearing.

4.2.5: The Dispute Resolution Board’s resolution of the dispute will be given in writing, to both SEPTA and the Contractor, within fourteen (14) days of completion of the hearing. In exceptionally difficult cases, this time may be extended by mutual agreement of all parties. If requested by either party, the Dispute Resolution Board shall meet with SEPTA and Contractor to provide additional clarification of its determination. The determination rendered by the Dispute Resolution Board shall be final, conclusive and binding, and judgment upon the determination may be entered in any court having jurisdiction thereof.

4.2.6: Within fourteen (14) days of receiving the Dispute Resolution Board’s recommendations, or such other time as the SEPTA and Contractor may agree in writing, SEPTA and Contractor shall promptly process and execute any resulting Change Order.

4.2.7: Performance During Disputes - Unless otherwise directed by SEPTA in writing, Contractor shall continue its performance under this Contract while the matter in dispute is being resolved. If the Contractor fails or refuses to perform as directed, such action shall constitute an Event of Default hereunder.
GC 4.3 Communications
Communications in connection with this Contract shall be in writing and shall be delivered personally; or by facsimile; or by regular, registered, or certified mail addressed to the officer(s) or employee(s) of SEPTA and of the Contractor designated to receive such communications. Telephone calls may be used to expedite communications but shall not be official communication unless confirmed in writing.

Electronic [serially numbered letter] mail shall be an acceptable form of communication for this Contract; all [serially numbered letter] E-mail transmittals must be followed by the signed paper document(s) -- with attachment(s), if any, as described therein -- in order to qualify as bona fide official communication between Contractor and SEPTA.

GC 4.3.1 Notices
All notices given by either party to the other shall be effective only if given in writing and sent to the following addresses of the parties, or to such other addresses as may be designated by the parties in writing. Notice shall be effective upon receipt.

TO SEPTA:

Senior Director of Procurement - Procurement & Supply Chain Management Department
Southeastern Pennsylvania Transportation Authority
1234 Market Street, 11th Floor
Philadelphia, Pennsylvania 19107-3780

TO CONTRACTOR:

Title: ___________________________________________________
Company: _______________________________________________
Address: ________________________________________________

GC 5. Delivery and Title

GC 5.1 Deliveries

GC 5.1.1 Bus Delivery Procedure
Delivery of the Buses shall be determined by signed receipt of SEPTA's designated agent(s), at the following point of delivery and may be preceded by a delivery acceptance inspection of the bus at the final assembly plant. Reference GC 5.1.3 – Pre-Delivery Test and Inspections.

SEPTA
Germantown Brake Center
6725 Germantown Avenue
Philadelphia, PA 19119
Telephone: 215-580-6981
GC 5.1.2  Delivery Schedule
Delivery shall be as required in SP 2.

All the Buses are to be delivered in first class condition, complete, ready for operation or use, and in conformity with the Specifications and other terms and conditions of the Contract, with the exterior washed, the interior free of litter, and with fuel equaling at least two-thirds (2/3) of the total fuel capacity of each unit, if applicable. Contractor's delivery drivers must report to SEPTA any and all vehicle related incidents which occurred en route.

SEPTA shall accept up to ten (10) buses per week. Any deliveries greater than ten (10) per week shall require approval by the SEPTA project manager.

Delivery of Buses to SEPTA shall occur between the hours of 6:00 A.M. and 2:30 P.M. Monday through Friday, except for legal holidays. All drivers delivering Buses on behalf of the Contractor must be informed of these hours and notified that SEPTA will not accept after hour delivery. If the Contractor is late with delivery of the Buses, SEPTA may allow delivery on Saturday between the hours of 10:00 A.M. and 3:00 P.M. provided written notice from Contractor of said delivery is given to and accepted by SEPTA at least forty-eight (48) hours prior to the scheduled delivery time and date.

GC 5.1.3  Pre-Delivery Tests and Inspections
The pre-delivery tests and inspections shall be performed at or near the Contractor's plant; they shall be performed in accordance with the procedures defined in Section 8 - Quality Assurance and they may be witnessed by the SEPTA’s resident inspector. When the Bus passes these tests and inspections, the resident inspector shall authorize release of the Bus.

Inspection
A. Definition. "Material and/or Equipment," as used in this paragraph, GC 5.1.3 – Pre-Delivery Test and Inspections., includes but is not limited to raw materials, components, intermediate assemblies, end products, and lots of supplies.

B. The Contractor shall provide and maintain an inspection system acceptable to SEPTA covering Material and/or Equipment under the Contract and shall tender to SEPTA for acceptance only Material and/or Equipment that has been inspected in accordance with the inspection system and has been found by the Contractor to be in conformity with Contract requirements. As part of the system, the Contractor shall prepare records evidencing all inspections made under the system and the outcome. These records shall be kept complete and made available to SEPTA during Contract performance and for as long afterwards as the Contract requires. SEPTA may perform reviews and evaluations as reasonably necessary to ascertain compliance with this paragraph. These reviews and evaluations shall be conducted in a manner that will not unduly delay the Contract work. The right of review, whether exercised or not, does not relieve the Contractor of its obligations under the Contract.

C. SEPTA has the right to inspect and test all Material and/or Equipment called for by the Contract, to the extent practicable, at all places and times, including the period of manufacture, and in any event before acceptance. SEPTA shall perform inspections and tests in a manner that will not unduly delay the work. SEPTA assumes no contractual obligation to perform any inspection and test for the benefit of the Contractor unless specifically set forth elsewhere in the Contract.
D. If SEPTA performs inspection or tests on the premises of the Contractor or a subcontractor, the Contractor shall furnish, and shall require subcontractors to furnish, without additional charge all reasonable facilities and assistance for the safe and convenient performance of these duties. Except as otherwise provided in the Contract, SEPTA shall bear the expense of SEPTA inspections or tests made at other than the Contractor's or subcontractor's premises; provided that in case of rejection, SEPTA shall not be liable for any reduction in the value of the inspected equipment or test samples.

E. 1. When Material and/or Equipment is not ready at the time specified by the Contractor for inspection or test, SEPTA may charge the Contractor for the additional cost of inspection or test.

2. SEPTA may also charge the Contractor for any additional cost of inspection or test when prior rejection makes reinspection or retest necessary.

F. SEPTA has the right either to reject or to require correction of nonconforming Material and/or Equipment. Material and/or Equipment is nonconforming when it is defective in material or workmanship or is otherwise not in conformity with Contract requirements. SEPTA may reject nonconforming Material and/or Equipment with or without disposition instructions.

G. The Contractor shall remove Material and/or Equipment rejected or required to be corrected. However, SEPTA may require or permit correction in place, promptly after notice, by and at the expense of the Contractor. The Contractor shall not tender for acceptance corrected or rejected Material and/or Equipment without disclosing the former rejection or requirement for correction, and, when required, shall disclose the corrective action taken.

H. If the Contractor fails to promptly remove, replace, or correct rejected Material and/or Equipment that is required to be removed or to be replaced or corrected, SEPTA may either (1) by contract or otherwise, remove, replace, or correct the Material and/or Equipment and charge the cost to the Contractor or (2) terminate the Contract for default. Unless the Contractor corrects or replaces the Material and/or Equipment within the Contract specified delivery schedule, SEPTA may require delivery of Material and/or Equipment in accordance with a reasonable delivery schedule as determined by SEPTA and make an equitable price reduction in accordance with GC 2.9 – Change Orders.

I. 1. If the Contract provides for the performance of SEPTA quality assurance at source, and if requested by SEPTA, the Contractor shall furnish advance notification of the time (i) when Contractor inspection or tests will be performed in accordance with the terms and conditions of the Contract and (ii) when the Material and/or Equipment will be ready for SEPTA inspection.

2. SEPTA's request shall specify the period and method of the advance notification and SEPTA representative to whom it shall be furnished. Requests shall not require more than two (2) workdays of advance notification if a SEPTA representative is in residence in the Contractor's plant, nor more than seven (7) workdays in other instances.
J. SEPTA shall accept or reject, in writing, Material and/or Equipment as promptly as practicable after delivery, unless otherwise provided in the Contract. SEPTA's failure to inspect and accept or reject the Material and/or Equipment shall not relieve the Contractor from responsibility, nor impose liability on SEPTA for nonconforming Material and/or Equipment.

K. Inspections and tests by SEPTA do not relieve the Contractor of responsibility for defects or other failures to meet Contract requirements discovered before acceptance. Acceptance shall be conclusive, except for latent defects, fraud, gross mistakes amounting to fraud, or as otherwise provided in the Contract.

L. If acceptance is not conclusive for any of the reasons in Paragraph K. above, SEPTA, in addition to any other rights and remedies provided by law, or under other provisions of the Contract, shall have the right to require the Contractor (1) at no increase in Contract Price, to correct or replace the defective or nonconforming Material and/or Equipment at the original point of delivery or at the Contractor's plant at SEPTA's election, and in accordance with a reasonable delivery schedule as may be agreed upon between the Contractor and SEPTA; provided, that SEPTA may require a reduction in contract price if the Contractor fails to meet such delivery schedule, or (2) within a reasonable time after receipt by the Contractor of notice of defects or nonconformance, to repay such portion of the Contract as is equitable under the circumstances if the Contract Administrator elects not to require correction or replacement. When Material and/or Equipment is returned to the Contractor, the Contractor shall bear the transportation cost from the original point of delivery to the Contractor's plant and return to the original point when that point is not the Contractor's plant. If the Contractor fails to perform or act as required in (1) or (2) above and does not cure such failure within a period of ten (10) days (or such longer period as SEPTA may authorize in writing) after receipt of notice from SEPTA specifying such failure, SEPTA shall have the right by contract otherwise to replace or correct such Material and/or Equipment and charge to the Contractor the cost occasioned SEPTA thereby.

GC 5.1.4 Assumption of Risk of Loss
All risk of loss or damage to the Material and/or Equipment or any part thereof, prior to proper delivery to SEPTA and final written acceptance thereof by SEPTA shall be borne by Contractor. Contractor shall pay all transportation costs to the designated delivery site and shall provide and pay for all insurance as outlined in GC 11.1 "Insurance", of the Contract.

If a Bus is found to be damaged or defective upon delivery or the release of the vehicle was not approved by the SEPTA's in-plant inspectors, SEPTA reserves the right to reject the Bus upon delivery and have it removed from its property by the Contractor at the Contractor's expense. If the vehicle is rejected and the Contractor's delivery driver has left SEPTA property, SEPTA shall place the Bus on the nearest side street with parking available and immediately advise the Contractor as to the location of the Bus. SEPTA shall have no liability for any damage, including vandalism, resulting from such a rejection.

Any loss or damage to the Material and/or Equipment prior to delivery to SEPTA and final written acceptance thereof by SEPTA shall be made good by Contractor at its own cost and the performance of the Contract shall be carried forward in accordance with its terms and conditions at no additional cost to SEPTA. SEPTA may, however, grant reasonable extensions to the completion date where loss or damage is not the result of the negligence of Contractor, its employees or agents.
GC 5.1.5 Acceptance of Bus
Within fifteen (15) calendar days after arrival at the designated point of delivery, each Bus shall undergo tests by SEPTA as defined in the Section 6 – Technical Specifications. If a Bus passes these tests, the Bus shall receive final written acceptance by SEPTA on the fifteenth calendar day after delivery, except that SEPTA reserves the right to accept the Bus earlier than the fifteenth calendar day after delivery if SEPTA notifies the Contractor in writing of early acceptance or places the Bus in revenue service.

If a Bus fails these tests, SEPTA shall notify the Contractor that the Bus shall not be accepted until the repair procedures defined in GC 6 – Repairs After Non-Acceptance have been carried out and the Bus has been re-tested and subsequently passes all required tests to SEPTA's satisfaction.

GC 6. Repairs After Non-Acceptance
In the event that SEPTA does not accept a Bus, SEPTA may require the Contractor to perform required repairs after non-acceptance, or SEPTA may, at its sole option, perform required repairs using personnel employed by SEPTA. In either case, the Contractor shall be liable to SEPTA for all costs associated with the required repairs.

GC 6.1 Repairs By Contractor
If SEPTA requires the Contractor to perform repairs after non-acceptance of the Bus, the Contractor must begin work within seven (7) calendar days after receiving notification from SEPTA of the Bus having failed to pass the acceptance tests. SEPTA shall make the coach available to the Contractor for completion of repairs.

Contractor shall provide, at its sole expense, all parts, tools, personnel and space required to complete the repairs. At SEPTA's sole option, Contractor may be required to remove the Bus from SEPTA property for repair work. Repair procedures must be diligently pursued by the Contractor, and Contractor shall continue to have all risk of loss until SEPTA's final written acceptance of the Bus. At its sole discretion, SEPTA may provide shop space to complete repairs, subject to availability.

GC 6.2 Repairs By SEPTA
Parts Used: If SEPTA decides to perform the repairs after non-acceptance of a Bus, it shall correct or repair the defect and any related defects using Contractor-specified parts available from SEPTA's own stock or parts supplied by the Contractor specifically for the repair. Monthly, or at a period to be mutually agreed upon, reports listing all repairs performed under this Paragraph, and the cost thereof, shall be submitted by SEPTA to the Contractor. The Contractor shall provide forms which are acceptable to SEPTA for making these reports.

If the Contractor supplies parts for repairs being performed by SEPTA after non-acceptance of a Bus, the parts shall be shipped prepaid to SEPTA from any source selected by the Contractor within five (5) working days after receipt of a written request from SEPTA for said parts.

Contractor may request that defective parts replaced under this provision be returned to the manufacturing plant. The total cost, including but not limited to packing and handling by SEPTA as well as all transportation charges, for returning said parts shall be paid by the Contractor.

SEPTA shall be reimbursed by the Contractor for the cost of parts in SEPTA's inventory consumed to correct or repair the defect or any related defect. The reimbursement shall include a part value percent handling cost per Section 7 – Warranty Requirements, WR 1.2.3.6 – Reimbursement for Parts.
Reimbursement for Labor: SEPTA shall be reimbursed by the Contractor for labor expended by SEPTA's personnel in performing repairs in accordance with this Paragraph. The amount shall be determined by multiplying the number of man-hours actually required to correct the defect by the per-hour rate (straight time) paid by SEPTA at the time of the repair work to the mechanic(s) actually performing the repair work, plus labor fringe rate and corporate overhead rate, plus the cost of towing the vehicle if such action was necessary. SEPTA shall not accept or consider parts credits as reimbursement for labor.

GC 7. Unavoidable Delays

GC 7.1 Delay In Completion Beyond Contractor’s Control
If Contractor shall be delayed in the completion and performance under the Contract by reason of unforeseeable causes beyond its control and without its contribution, neglect, fault, or negligence, including but not restricted to acts of God, acts of neglect of SEPTA, acts of neglect of the contractor’s primary subcontractors, fires, floods, epidemics, quarantines, strikes, or freight embargoes, the time herein specified for completion of Contract performance may be extended at the reasonable discretion of SEPTA, by such time as shall be fixed by SEPTA in writing. The Contractor shall not be entitled to any damages, compensation, or adjustment from SEPTA on account of any delay or delays, including delays in payment to Contractor, resulting from any of the aforesaid causes.

GC 7.2 Extension Of Time, Not Waiver Of Timely Performance
Any extension of time granted by SEPTA pursuant to GC 7.1 above shall operate only to mitigate Liquidated Damages contained in GC 7.3; no such extension of time shall be deemed a waiver by SEPTA of its right to terminate the Contract for delay by the Contractor, nor shall such extension relieve Contractor from full responsibility for performance of its obligations hereunder.

If the Contractor desires to apply for an extension of time pursuant to GC 7.1 above, Contractor shall notify SEPTA in writing and submit a Time Impact Analysis (TIA) within fourteen (14) days after becoming aware of the possibility of delay and any reasons for the delay and its estimated duration.

GC 7.3 Liquidated Damages
In the event that Buses (both Base Order and any Option Order) to be furnished under the Contract are not furnished in accordance with the Specifications, properly adjusted, tested and ready for use by SEPTA as required by the Specifications, on the day herein fixed as the completion date, $100.00 per day per Bus shall be paid to SEPTA by Contractor, or shall be deducted from any amount due to the Contractor by SEPTA, as Liquidated Damages for every day or part thereof that the performance of the Contract shall remain uncompleted after the completion date for delivery of the Buses set forth in SP 2, as it may be modified by SEPTA in accordance with GC 7.1 - Delay in Completion Beyond Contractor's Control. All Liquidated Damages may be deducted from approved invoices at any time during the contract performance period. Liquidated Damages are limited to ten (10) percent of the total contract value.

In the event of delays, which are not subject to GC 7.1 - Delay in Completion Beyond Contractor's Control, in delivery of spare parts, performance of training or receipt of the Parts and Maintenance Manuals beyond the dates and schedule specified in the Contract Documents, SEPTA shall assess liquidated damages in the amount of $100.00 per calendar day per item or service not delivered or accomplished. An item is defined as a spare part or manual(s).

GC 7.4 Title
Contractor covenants and warrants that good title to all the Material and/or Equipment furnished under the Contract shall vest in SEPTA immediately upon acceptance by SEPTA of the Material and/or Equipment.
Adequate documents for securing title to each Bus in the Commonwealth of Pennsylvania shall be provided to SEPTA by Contractor at least fifteen (15) calendar days before each Bus is released to the common carrier driveway company.

**GC 8. Payment**

SEPTA will not issue any payments in this section prior to complete Altoona Testing documentation being received and verified by the SEPTA Project Manager. SEPTA shall pay invoices submitted by the Contractor within thirty (30) calendar days after approval of an invoice by the Project Manager.

SEPTA shall make progress payments to the Contractor for all Material and or Equipment in accordance with the payment schedule below:

1. Three percent (3%) of the Total Price for all of the 40’ Low-Floor Buses including any option orders, if exercised, as set forth in Appendix 2 upon written approval by SEPTA of the award of major Subcontracts (that is, the Subcontracts for the Powertrain, HVAC, axles, Bus framing material and ASAS/CARD System). Invoice for this milestone shall be accompanied by a copy of purchase orders for each major subcontract.

2. SEPTA will pay thirty percent (30%) of the per Bus price set forth on Appendix 2 for each Bus upon SEPTA's written acceptance for each Bus of the Bus shell on all axles installed in the manufacturing cycle at the final assembly location.

3. SEPTA will pay thirty percent (30%) of the per Bus price set forth on Appendix 2 for each Bus upon SEPTA's written approved shipment from the final assembly location.

4. SEPTA will pay thirty two percent (32%) of the per-Bus price set forth on Appendix 2 for each Bus upon the delivery and SEPTA's written acceptance of each Bus in Philadelphia, PA.

5. An Additional 3% of the Total Price for all of the 40’ Low-Floor Buses including any option orders, if exercised, as set forth in Appendix 2 will be paid once all of the following requirements are satisfied:
   a. Delivery to and written acceptance by SEPTA of all Contract deliverables;
   b. Rectification by Contractor of all deficiencies found by SEPTA;
   c. Receipt of all required certifications, in a form and substance satisfactory to SEPTA in its sole judgment; and
   d. Completion of all post-delivery audits to SEPTA's sole satisfaction.

**Additional Withholding.** SEPTA will withhold the remaining two percent (2%) of the total cost of each delivered and accepted Bus to assure correction of apparent failures and fleet defects. These withheld funds shall be paid in full to the Contractor within seventy-five (75) working days of Bus acceptance, unless specific defects are found in the Bus or it is subject to a fleet defect. The defect(s) found shall be described and submitted in writing by SEPTA, including the relevant specification requirement, to the Contractor when identified and within the seventy five (75) working day withholding period. The withheld funds shall be paid in full to the Contractor upon repair of the Bus.

6. All payments for milestones involving Bus assembly at the Contractor's plant require written approval by the SEPTA's Resident Inspector or Designee and shall be accompanied by an affidavit signed and notarized by the Contractor's duly authorized Officer certifying that the work covered by the progress
payment requested has been completed. All other milestones and final acceptance require written approval of the Project Manager.

(7) Capital spare parts, special tools and equipment, publications & training, training aids and simulators shall be paid for by SEPTA at the amounts set forth in Appendix 2 upon their delivery to and written acceptance by SEPTA in Philadelphia.

(8) An invoice shall be submitted to SEPTA’s designated Project Manager for each vehicle. Each invoice must include the following:

- Invoice Number
- SEPTA Purchase Order Number
- Vehicle Identification Number (VIN)
- SEPTA Fleet Number of Vehicle
- Serial Number(s) of the Engine
- Serial Number of Drive Unit
- Cost of Optional Warranties
- Total Invoice Amount

A Manufacturer Certificate of Origin for a Vehicle (MCO or COO) for each vehicle must be supplied to SEPTA by the Contractor at least fifteen (15) calendar days prior to shipment of a Bus.

SEPTA shall have the right, before paying any invoice, to require Contractor to furnish proof that all suppliers and workmen employed in connection with the performance of the Contract or any part thereof have been fully compensated by Contractor unless there are good and sufficient reasons, as determined by SEPTA in its sole discretion, such as the cases where the Contractor has negotiated payment schedules with Subcontractor that do not allow the Contractor to respect the preceding principle.

**GC 9. Service and Parts**

**GC 9.1 Engineer / Service Representatives**
The Contractor shall, at its own expense, have a competent engineering service representative(s) available on request to assist SEPTA staff 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 Section 7 - Warranty Requirements.

**GC 9.2 Documents**
Contractor shall provide current maintenance and parts manuals as outlined in the Specifications through the Warranty period. These computer manuals must detail, describe and be in reference to the actual vehicle built for SEPTA by the Contractor. Contractor shall provide operator manuals for each vehicle delivered as provided in the Specifications. After the Warranty period is completed the Contractor is responsible for providing electronic updates related to changed service requirements, recalls, retrofit and parts over the twelve (12) year design life of the vehicle or until the Buses are no longer the property of SEPTA.

**GC 9.3 Parts Availability Guaranty**
Contractor shall guarantee the availability of replacement parts for each vehicle supplied under the Contract for a period of 12 years minimum from the date of Final Payment.
Contractor shall not make exclusive agreements with Suppliers and/or Sub-suppliers that would preclude SEPTA from purchasing components directly from Sub-suppliers.

All spare parts supplied shall be interchangeable with original equipment without any modifications and shall be manufactured in accordance with Quality Assurance Provisions contained in the Specifications.

The Contractor shall establish an inventory of body and structural parts available for delivery to SEPTA within 48 hours after placement of an order during the warranty period and 7 days for all other parts requests. This inventory should include skirt panels, front and rear body panels, trim stripes, windshields, front cap glazing.

**GC 9.4 Interchangeability**

All units and components within each of the Buses to be supplied under the Contract, whether provided by Subcontractors or manufactured by the Contractor, shall be duplicated in design, manufacture and installation to assure interchangeability among all Buses within each vehicle type provided under the Contract. The interchangeability will extend to individual components as well as to their locations in the Buses. Contractor shall notify SEPTA of impending changes due to product improvements and changes between production runs (See Section 6 – Technical Specifications, TS 5.19 – Interchangeability). SEPTA shall approve the changes in accordance with GC 2.9 – Change Orders. SEPTA will require up to 14 days to review the Contractor's changes. The Contractor shall furnish cost and technical documentation with the notification.

**GC 9.5 Survivability**

Contractor's obligations under this section GC 9 shall survive the nominal expiration or discharge of other Contract obligations and SEPTA may obtain any remedy under law, Contract or equity to enforce the obligations of Contractor that survive the manufacturing, warranty, and final payment periods.

**GC 9.6 Warranties**

**GC 9.6.1 Definitions**

"Acceptance," as used in this section, means the act of an authorized representative of SEPTA by which SEPTA assumes ownership of existing and identified Equipment, or approves specific services rendered, as partial or complete performance of the Contract.

"Correction," as used in this section, means the elimination of a defect.

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

"Material and/or Equipment," as used in this section, means the end items, including data, furnished by the Contractor and related services required under the Contract.

**GC 9.6.2 General**

Contractor warrants that all Material and/or Equipment, and installation thereof, meets all requirements and standards set by the Specifications. All Material and/or Equipment shall be new, the best of its kind or quality, reasonably fit for its intended use as set forth in the Specifications, and of safe, substantial, and durable construction. All installation shall be done in a good and workmanlike manner and shall be safe and operate in the manner intended in the Specifications. Contractor further warrants that any Material and/or Equipment, and installation thereof, shall conform to representations and descriptions, either oral or written, made by the Contractor and any literature, sample, or other vehicle of information supplied by Contractor prior to the time set.
for opening of the bids for the Contract. Contractor further warrants that any sample provided represents a minimum standard of quality for the Material and/or Equipment, and installation thereof, furnished hereunder.

**GC 9.6.3 Payment of Suppliers and Subcontractors**
Contractor warrants that all workmen, Subcontractors and Suppliers will be satisfied by Contractor prior to Contractor rendering final invoice to SEPTA so that, at the time SEPTA makes final payment to Contractor, no part of the performance under the Contract shall be subject to any claim or lien.

**GC 9.6.4 Material and/or Workmanship**
In addition to all warranties implied by law or required by the Specifications, Contractor expressly warrants all Material and/or Equipment, and installation thereof, against any defect in design, material or workmanship which may be discovered by SEPTA within one (1) year from the date of final acceptance of each coach and in accordance with the applicable warranty provision of Section 7 – Warranty Requirements. Contractor shall make any necessary repairs to and any replacements of all or parts of the Material and/or Equipment, and installation thereof, to make the vehicle or any subsystem thereof fully operational as designed and required by the Specifications at no additional cost to SEPTA.

**GC 9.6.5 Infringement of Patents**
Contractor shall defend, indemnify, and save harmless SEPTA, its officers, agents, servants, and employees from liability of any kind and will pay all costs and expenses for or on account of or arising from any infringement or violation or alleged violation of any copyright or patent or any right of any person, firm or corporation resulting from any act, omission, or negligence on the part of the Contractor in the performance of the Contract.

**GC 9.6.6 Additional Warranties**
1. If the customary standard warranties for the Material and/or Equipment, and installation thereof, exceed the period(s) specified above, such warranties shall run to SEPTA.

2. If separate or additional warranties covering the Material and/or Equipment are furnished by the manufacturer, supplier, or seller of component part or parts of any item of said Material and/or Equipment, SEPTA shall have the right, but not the duty, to benefit from these separate or additional warranties, along with the primary warranties set forth hereinabove and enumerated in Section 7 – Warranty Requirements of this Contract. SEPTA shall look only to Contractor for fulfillment of all warranty requirements expressed and implied by the making of the Contract.

3. The existence of any separate or additional warranties which run to the Contractor from the manufacturer, supplier, or installer of a component part of an item of Material and/or Equipment shall not relieve Contractor of its obligation to repair or replace any of the Material and/or Equipment on account of faulty design, manufacture or workmanship during the warranty period. SEPTA shall not be required to look to any other party for fulfillment of warranty provisions.

4. If the Contractor becomes aware at any time before acceptance by SEPTA that a defect exists in any Material and/or Equipment or services, the Contractor shall (i) promptly correct the defect or (ii) promptly notify SEPTA, in writing, of the defect.

5. SEPTA determines that a defect exists in any of the Equipment or services accepted by SEPTA under the Contract, SEPTA shall promptly notify the Contractor of the defect, in writing, within "60days after discovery of the defect." Upon timely notification of the existence of a defect, or if the Contractor independently discovers a defect in accepted Material and/or Equipment or services, the Contractor shall submit to SEPTA,
in writing, within 15 days a recommendation for corrective actions, together with supporting information in sufficient detail for SEPTA to determine what corrective action, if any, shall be undertaken.

6. The Contractor shall promptly comply with any timely written direction from SEPTA to correct or partially correct a defect, at no increase in the Contract Price.

7. The Contractor shall also prepare and furnish to SEPTA data and reports applicable to any correction required under this section (including revision and updating of all other affected data called for under the Contract) at no increase in the Contract Price.

8. In the event of timely notice of a decision not to correct or only to partially correct, the Contractor shall submit a technical and cost proposal within fifteen days (15) to amend the Contract to permit acceptance of the affected Material and/or Equipment or services in accordance with the revised requirement, and an equitable reduction in the Contract Price shall promptly be negotiated by the parties and be reflected in a Change Order to the Contract in accordance with GC 2.9.- Change Orders. Contractor must become cognizant of SEPTA's Change Order processing time requirements.

9. Any Material and/or Equipment or parts thereof corrected or furnished in replacement and any services re-performed shall also be subject to the conditions of this paragraph to the same extent as Material and/or Equipment or services initially accepted. The warranty, with respect to these supplies, parts or services, shall be equal in duration to that set forth in GC 9.6.4 – Material and/or Workmanship, above, and shall run from the date of delivery of the corrected or replaced Material and/or Equipment and for Buses in accordance with applicable provisions (Section 6 – Technical Specification and Section 7 – Warranty Requirements).

10. The Contractor shall not be responsible under this paragraph for the correction of defects in SEPTA furnished property, except for defects in installation, unless the Contractor performs, or is obligated to perform, any modifications or other work on such property. In that event, the Contractor shall be responsible for correction of defects that result from the modifications or other work.

11. If SEPTA returns Material and/or Equipment to the Contractor for correction or replacement under this paragraph, the Contractor shall be liable for transportation charges up to an amount equal to the cost of transportation by the usual commercial method of shipment from the place of delivery specified in the Contract (irrespective of the f.o.b. point or the point of acceptance) to the Contractor's plant and return to the place of delivery specified in the Contract. The Contractor shall also bear the responsibility for the supplies while in transit.

**GC 9.6.7 Remedies Available to SEPTA**

The rights and remedies of SEPTA provided in this paragraph

(i) Shall not be affected in any way by any terms or conditions of the Contract concerning the conclusiveness of inspection and acceptance; and

(ii) Are in addition to and do not limit any rights afforded to SEPTA by any other Paragraph of the Contract.

Within 30 days after receipt of the Contractor's recommendations for corrective action and adequate supporting information, SEPTA, at its sole discretion, shall give the Contractor written notice not to correct any defect, or to correct or partially correct any defect within a reasonable time at either Contractor's facility or at a SEPTA provided location, as determined by SEPTA.
In no event shall SEPTA be responsible for any extension or delays in the scheduled deliveries or periods of performance under the Contract as a result of the Contractor's obligations to correct defects, nor shall there be any adjustment of the delivery schedule or period of performance as a result of the correction of defects unless provided by a Change Order with adequate consideration to SEPTA.

This clause shall not be construed as obligating SEPTA to increase the Contract Price.

Any failure or refusal of the Contractor to take corrective action as required by this Paragraph shall be grounds for Termination for Cause in accordance with GC 4.1.2.

**GC 10. Audit and Inspection of Records**

SEPTA Audit Rights:
Contractor shall keep written records in reasonable detail of all services performed by it under the Contract. All written records, reports, work sheets, data, and information prepared, generated, or obtained in connection with Contractor’s performance of services for SEPTA shall be made available during the term of the Contract and for a period of five (5) years thereafter, together with all books and other data or information, in whatever form contained, relating to Contractor’s performance under the Contract. Contractor shall permit the audit and examination of the aforementioned material, including the making of excerpts and transcriptions, by appropriate officers or representatives of SEPTA and any governmental funding agency providing financial assistance for the Project, including the United States Department of Transportation, the Office of the Comptroller General of the United States, and the Pennsylvania Department of Transportation.

Contractor shall require its subcontractors/subconsultants to keep written records in reasonable detail of all services performed by them for Contractor under the Contract and to maintain all books, data, information and records in a form that will support the invoice billed to Contractor. Contractor shall further require that all written records, reports, work sheets, data, and information prepared, generated, or obtained in connection with such subcontractor’s/subconsultant’s performance of services for Contractor shall be made available during the term of the Contract and for a period of five (5) years thereafter to SEPTA, together with all books and other data or information, in whatever form contained, relating to such subcontractor’s/subconsultant’s performance for Contractor.

**GC 11. Risk**

SEPTA MUST BE PROVIDED WITH TRUE COPIES OF DECLARATION PAGES AND POLICIES OF INSURANCE UPON REQUEST. SEPTA MUST BE LISTED AS AN ADDITIONAL INSURED AND MUST BE THE CERTIFICATE HOLDER ON ALL APPLICABLE LIABILITY COVERAGE EXCLUDING WORKERS COMPENSATION AND PROFESSIONAL LIABILITY WITH RESPECT TO THIS PROJECT AND IT SHOULD BE NOTED ON THE INSURANCE CERTIFICATE AND POLICIES. SEPTA MUST BE PROVIDED WITH ACCEPTABLE PROOF AND ANY ADDITIONAL EVIDENCE OF INSURANCE THAT DEMONSTRATES COMPLIANCE WITH THESE REQUIREMENTS AS WELL AS ALL LIMITS AND OTHER MANDATED ASPECTS OF COVERAGE.

**GC 11.1 Commercial General Liability Insurance**
The Contractor shall purchase and maintain such insurance as will protect it from claims set forth below which may arise out of or result from the Contractor's operations under the Contract, whether such operations are by itself or by any Subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable:
1. Worker's Compensation claims as required by the laws of the State(s) in which the Contractor is conducting operations in connection with this Project, and specifically including the Commonwealth of Pennsylvania;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of its employees (Employee Liability Insurance);

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than its employees;

4. claims for damages insured under Personal and Advertising Injury liability coverage which are sections of a standard Commercial General Liability Policy; and

5. claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.

GC 11.2 Evidence of Compliance
1. Certificates of Insurance

Within ten (10) days after receipt from SEPTA of notice of Intent to Award of the Contract, the Contractor shall furnish SEPTA with CERTIFICATES OF INSURANCE and any other documents which SEPTA may require, such as copies of policies or endorsements, as evidence of compliance with these Insurance Requirements. All insurance carriers for these coverages shall have an A. M. Best Rating of at least B+.

2. Written Approval Required

Such Certificates or other documents must be approved in writing by SEPTA before a NOTICE TO PROCEED will be given.

GC 11.3 Policies to Remain in Force
1. Until Completion and Acceptance

All insurance coverage which the Contractor is required to provide for the Contract shall be maintained in full force and effect until all of the Material and/or Equipment of the Contract training and for the period specified under the Maintenance (or Warranty) Bond shall have been completed and accepted by SEPTA.

2. All policies shall provide for thirty (30) days written notice to SEPTA before cancellation by the Company issuing the insurance. If such notice is not provided for within the basic terms of the policy, it shall be provided by endorsement or notation of the Certificate.

3. Replacement Coverage Required

In the event that any or all of the insurance coverages required by the Contract are cancelled, are reduced below the required minimum limits or lapse, then the Contractor will be suspended from further prosecution of the Material and/or Equipment until such time as replacement coverage satisfactory to SEPTA has been obtained and is in force.
GC 11.4 Additional Insureds Required
The Contractor shall have all policies, i.e., the Commercial General Liability and Automobile Liability Policies endorsed to include the following as Additional Insureds: Southeastern Pennsylvania Transportation Authority.

GC 11.5 Waiver of Liability for Premiums
All policies wherein the parties designated in GC 11.4 are included as additional insureds shall contain a Waiver of Liability for the payment of premiums covering those additional Insureds.

GC 11.6 Limits of Liability
The insurance required by GC 11.1 shall be written for not less than any limits of liability specified below or required below, whichever is greater.

1. Workers’ Compensation Insurance
   As required by the applicable laws of the Commonwealth of Pennsylvania and any other State where the Contractor is conducting operations in the performance of this project.

2. General Liability Insurance (excluding Vehicles)
   Commercial General Liability Insurance for Bodily Injury and Property Damage to others, including Product and Operations Liability:

   (a) Minimum Limits to Liability
       Combined Single Limit (Bodily Injury and Property Damage) per occurrence $5,000,000.
       Combined Single Limit (Products-Completed Operations) per occurrence $5,000,000.
       General Aggregate not less than $10,000,000 annual aggregate.
       If this coverage is written on a claims basis, there shall be a three (3) year discovery period. Note that SEPTA will accept Competed Operations Coverage insurance for three years in lieu of.

   (b) Additional Insureds
       Policy shall be written or endorsed to include as additional Insureds those parties or persons designated in GC 11.4.

   (c) Contractual Liability (Hold Harmless) Coverage
       Policy shall be written or endorsed to include coverage for the liability assumed by the terms of the Contract, including GC 14 - Indemnification. Certificate or policy will state that the coverage applies to the Contract described as: "Purchase of Heavy Duty 40-Foot Low Floor Buses".

GC 11.7 Vehicle Liability
Liability Insurance (covering all autos, trucks, and other vehicles used in connection with the Project or Contract) for Bodily Injury and Property Damage to others.

(a) Minimum Limits of Liability
    Combined Single Limit (Bodily Injury and Property Damage) per occurrence $5,000,000.
(b) **Additional Insureds**

Policy shall be written or endorsed to include as Additional Insureds those parties or persons designated in GC 11.4. SEPTA must be listed as an additional insured and must be the certificate holder on all applicable liability coverage excluding workers compensation and professional liability with respect to this project and it should be noted on the insurance certificate and policies.

(c) **Hired and Other Non-Owned Vehicles**

Vehicle Liability Policy shall be written or endorsed to include coverage for Hired, Leased or other Non-Owned Vehicles.

**GC 12. Performance Bond**

**GC 12.1 Contract Security**

Chapter 2 Within fifteen (15) days of Notice of Award and before the Notice to Proceed and issuance of the Purchase Order, the Contractor shall furnish and maintain properly executed AIA A311 Performance Bond by a good and sufficient surety and/or an irrevocable and automatically renewable Letter of Credit (LOC) written by a United States bank with headquarters based in the United States and in a form acceptable to SEPTA. If the surety shall become insolvent or bankrupt in a technical or equitable sense, or otherwise become unqualified to underwrite the bond or the Contract Sum is adjusted so as to exceed the penalties of such bond, SEPTA may require, on fifteen (15) days written notice, the Contractor to furnish new or additional bond from the same or different surety so as to be fully secured at all times. Bond must be issued by a fully qualified surety company acceptable to SEPTA and listed as a company currently authorized under 31 CFR Part 223 as possessing a Certificate of Authority as described herein. The Performance Bond shall be effective from the award date until the date of completion of the two year warranty period, provided, however, that thirty (30) days after acceptance or conditional acceptance of the final bus (Base Order plus Options, if elected) the Contractor may substitute a Maintenance (or Warranty) Bond in accordance with GC 12.2 below.

As stated within GC 2.1 – Contract Award and Execution, the Contract Sum could be adjusted in accordance with Appendix 2 to the extent SEPTA purchases any Option Buses; hence, the performance bonding must be increased to reflect any and all increases in Contract Sum. Note that the original Performance Bond must be increased or an additional Performance Bond must be acquired in order to fulfill performance bonding requirements resulting from option orders. Performance Bond requirements are defined as follows:

- Twenty-Five (25%) percent of the annual Total Price for all of the 40’Low-Floor Buses including any option orders, if exercised, as set forth in Appendix 2 until final acceptance of last production bus for the corresponding production year.
- Five (5%) percent of the Contract Sum until completion of the two-year warranty.

**GC 12.2 Maintenance (Or Warranty) Bond**

At least 30 days prior to the date of delivery of the last vehicle, the Contractor shall furnish for approval to SEPTA and once accepted maintain a properly executed Maintenance (or Warranty) Bond, written by the same corporate surety that provides the Performance Bond, in a form acceptable to SEPTA, in the amount 5% of the Total Price for all of the 40’ Low-Floor Bus including any and all options, if exercised, until completion of the first year of the two year warranty period and 2.5% for the second year of the warranty period. This Bond shall secure the Contractor's faithful performance of his warranty obligations.
in this Contract, until expiration of warranty coverage and completion of all modification work on all
items, including publication changes.

GC 13. Production of Documents
Upon award of the Contract to a Contractor, such Contractor shall commence performance under the Contract by
executing all Contract Guaranty Agreements provided with the Proposal, 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 fifteen (15) 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 GC 4.1.2 - Termination for
Default.

GC 14. Indemnification
In addition to all other obligations of Indemnification specified herein, Contractor agrees to release and be liable
for and to defend, indemnify and save harmless SEPTA, its Board Members, officers, agents, servants, workmen,
employees, subsidizers and indemnities, the Pennsylvania Department of Transportation, the City of Philadelphia
and any and all government funding agencies providing funds or services in connection with this Project
(hereinafter collectively referred to as "SEPTA"), from and against any and all loss, cost, damage, liability and
expense, including consequential damages, counsel fees, whether or not arising out of any claim, suit or action at
law, in equity, or otherwise, of any kind or nature whatsoever, including negligence, arising out of the
performance of the work by reason of any accident, loss or damage of property, including the work site, property
of SEPTA and Contractor, or injury, including death, to any person or persons, including employees of SEPTA,
Contractor, subcontractors at any tier or any person working on Contractor’s behalf, caused by Contractor, which
may be sustained either during the term of the Contract, or upon or after completion of the Project, whether
brought directly by these persons or by anyone claiming under or through them including heirs, dependents and
estates.

Contractor also agrees for itself and on behalf of its agents, servants, subcontractors, materialmen and employees
to defend, indemnify and hold harmless SEPTA from and against any and all claims of any kind or nature
whatsoever regarding subcontractors and materialmen and agrees to assume the defense of SEPTA to any such
suit at its cost and expense. The Contractor further assumes the risk of loss and damage to materials, machinery
and equipment to be incorporated in the Work at all times prior to delivery to the Project site or while in the
possession or under the control of the Contractor.

Contractor, for itself and its employees, Board members, officers, agents, servants, workmen, contractors,
subcontractors, licensees and invitees, or any other person working on Contractor's behalf, hereby releases and
agrees to be liable for and to defend, indemnify and save harmless SEPTA, except to the extent that SEPTA is
negligent in whole or in part, for any claims made by an employee, Board member, officer, agent, workman or
servant of Contractor's or any other person working on Contractor's behalf, including claims for compensation or
benefits payable to any extent by or for Contractor under any workers' or similar compensation acts or other
employee benefit acts, and Contractor expressly waives its statutory protection under §303, as amended, of The
Pennsylvania Workers’ Compensation Act, 77 P.S. §481 (b).

In addition, Contractor shall indemnify SEPTA for any fines and legal fees incurred because employees, agents,
or workers supplied by Contractor are not authorized to work in the United States.
GC 15. Materials / Accessories Responsibility
The Contractor shall be responsible for all materials and workmanship in the construction of the Material and/or Equipment, whether the same are manufactured by the Contractor or purchased from Supplier. This provision excludes tires, fare boxes, radios, and any equipment leased or supplied by SEPTA, except insofar as such equipment procured by the Contract is damaged by the failure of a part or component for which the Contractor is responsible, or except insofar as the damage to such equipment is caused by the Contractor during the manufacture of the Buses. Risk of damage to or loss of the Buses is the subject of "Assumption of Risk of Loss" (GC 5.1.4).

GC 16. Other Requirements

GC 16.1 Technology License
1. The Contractor hereby grants to SEPTA on the Contractor's behalf, and on behalf of its Subcontractors, Suppliers and Manufacturers (as to whom the Contractor represents and warrants that it has the power and authority to grant such sublicense), an irrevocable, perpetual, royalty-free, nonexclusive license and sublicense ("Technology License") to use, itself or through its Agents, for the Approved Purposes described in Paragraph 2 of this section without recourse to the original Contractor, Subcontractor, Supplier or Manufacturer: all patented, copyrighted and unpatented technology, know-how, trade secrets and other proprietary rights, and documentation thereof (except manufacturing detailed drawings and software, which is separately defined at and licensed pursuant to this Section GC 16), which is included in the Vehicles, including but not limited to all Systems, Subsystems, assemblies, subassemblies, components, and interface systems and controls which are necessary for the maintenance and repair, modification and upgrading, overhaul and/or remanufacture of the Vehicles, and for the manufacture of parts which are unavailable for purchase, as defined below, all of which shall be designated the Licensed Technology.

2. SEPTA's rights under this Technology License shall be limited to its use for the following:
   i) evaluation and qualification for the purposes of future Vehicle procurements of Systems, Subsystems and components of Subsystems on the Vehicles to be delivered under this Contract;
   ii) preparation of specifications for future production orders of passenger Vehicles employing some or all of the Licensed Technology (the "Specification Purpose");
   iii) maintenance and repair of the Vehicles;
   iv) modification and upgrading of the Vehicles;
   v) overhaul and/or remanufacture of the Vehicles;
   vi) manufacture of parts for the Vehicles which become unavailable for purchase. The term "unavailable for purchase" means that a part is no longer being manufactured; or an inventory of the part in sufficient quantities to meet SEPTA's needs is not available for purchase; or no supplier will sell a part to SEPTA or cannot supply the part according to a delivery schedule that meets SEPTA's needs; or that no supplier will offer the part at a commercially reasonable price.
3. SEPTA shall not have the right under this Technology License either to use the Licensed Technology to manufacture itself, or to have manufactured for it by a third party as a sublicensee of SEPTA, either the Vehicles, Systems, Subsystems or components thereof, except as specified in the foregoing subparagraph (vi). The purposes described in the foregoing subparagraphs (i) through (vi) as limited by the immediately preceding sentence are referred to in this Article as the "Approved Purposes."

4. The Contractor shall provide SEPTA with all source code in third-party escrow for all software obtained or governed by this Agreement, in accordance with the Escrow Agreement to be mutually developed and agreed upon by both parties.

**GC 16.2 Software License**

1. The Contractor hereby grants to SEPTA on the Contractor's behalf, and on behalf of its Subcontractors, Suppliers and Manufacturers (as to whom the Contractor represents and warrants that it has or will have the power and authority to grant such sublicense), an irrevocable, perpetual, royalty-free, nonexclusive license and sublicense ("Software License") to use, itself or through its Agents, for the Approved Purposes without recourse to the original Contractor, Subcontractor, Supplier, or Manufacturer: all of the Software and the Documentation (defined in Paragraph 2 and 3 of this section) which is included in the Vehicles, and in all Systems, Subsystems, assemblies, subassemblies and components thereof, all interface systems and controls with respect to all of the above, all diagnostic and testing systems, and all other microprocessor-based systems and software necessary to permit SEPTA to implement the Approved Purposes, including all such systems and software which are necessary for the maintenance and repair, modification and upgrading, overhaul and/or remanufacture of the Vehicles and for the manufacture of parts which become obsolete or otherwise unavailable for purchase, all of which shall be designated the "Licensed Software."

2. The term "Software" shall mean any and all computer application programs which are incorporated as part of any System, Subsystem, assembly, subassembly or components thereof, or any interface system control between or among the Systems, Subsystems, assemblies, subassemblies, or component thereof, in the Vehicles, or which are used in connection with a system (which use involves microprocessors, controllers, drivers, or other electronic data processing elements) or which are used in connection with any related diagnostic or testing equipment (if any), together with all related Documentation, including without limitation the object code, source code (which, in the alternative may be required to be provided to an Escrow agent for the benefit of SEPTA) and pseudo-code versions of such assemblies, subassemblies, programs, firmware containing such programs, know-how protocols, listings, instruction sets, indices and other intellectual property necessary for SEPTA's use of the Software for the Approved Purposes in the form prepared by the Contractor, Subcontractor, Supplier or Manufacturer in the regular course of its business, or to the extent that the Technical Specification requires a different form, then in the form required by the Technical Specification.

3. The term "Software License Documentation," except as applicable to commercially available software, includes all user manuals, systems manuals, training materials, guides, logic diagrams, programmer's notes, flow charts, algorithms, development tools and development platforms, including Input/Output Documentation (defined in Paragraph 5) and other materials necessary for SEPTA's understanding and use of the Software for the Approved Purposes in the form prepared by the Contractor, Subcontractor, Supplier or Manufacturer in the regular course of its business, or, to the extent that the Technical Specification requires a different form, then in the form required by the Technical Specification.

4. Notwithstanding requirements otherwise set forth in this Article, for all Software determined by the Project Manager/Engineer to be commercially available software ("Third Party Software"), for example,
third party operating system software supplied by the Contractor, the Contractor shall at its own expense secure and administer for SEPTA, in SEPTA's name, any and all necessary sublicenses or direct licenses for such Third Party Software that allow SEPTA to use Third Party Software for the operations, maintenance and repair of the Vehicles. The Contractor shall use its best efforts to secure such sublicenses or direct licenses upon the same terms and conditions as the Licensed Software, or upon other terms and conditions which are acceptable to SEPTA. The scope of the Software License granted to SEPTA hereunder with respect to such Third Party Software shall be that provided in the applicable license as provided by the supplier thereof. The term "Software License Documentation" with respect to Third Party Software includes all user manuals, systems manuals, training manuals, guides and all other materials made available by the software developer to users of its software, including the Contractor.

5. The Contractor shall provide SEPTA with full documentation, in the form(s) required by the Technical Specification, as to all input/output protocols and operating parameters for microprocessor-based control systems installed in the Vehicles, provided, however, that SEPTA's right to disclose or use such information shall be limited to the Approved Purposes. The term "Input/Output Software License Documentation" shall mean a complete listing of all commands and operating parameters generated by electronic input devices, such as manual controls, sensors and test equipment used with the system, and responses generated by the controller to such devices, directives and responses sent between controllers and the output to the controlled system. Input/Output Software License Documentation shall also include complete specifications for all communication interfaces, external device drivers and analog/digital converters used by the control system, the addresses, parameters, priority and functions of all operating routines and the locations, structure and functions of all data stores.

6. The Contractor shall provide SEPTA with all source code in third-party escrow for all software obtained or governed by this Agreement, in accordance with the Escrow Agreement to be mutually developed and agreed upon by both parties.

GC 16.3 Software Standards
In its design of the Vehicles, the Contractor shall insure that all Software (i) conforms to those standard industry interfaces and protocols specified by SEPTA to permit interchangeability of Systems and Subsystems, (ii) is capable of maintenance, modification and upgrades in accordance with conventional software standards and practices, (iii) utilizes conventional command sequence and structure, and (iv) in all respects meets the software standards requirements of the Technical Specifications.

GC 16.4 Use of Copyrighted Material
The Licenses granted herein each shall entitle SEPTA to copy, modify and disseminate, solely for the Approved Purposes, all copyrighted material included in the Licensed Technology, and the Licensed Software, including (without limitation) manuals, drawings, diagrams, schematics, data bases, all materials furnished pursuant to GC 16.5 – Tangible Materials and GC 16.6 - Deliverables.

GC 16.5 Tangible Materials
The tangible copies of all drawings, schematics, parts lists, diagrams, manuals, Software, Software License Documentation and other data and documents, regardless of the media or form of its storage or use, furnished to SEPTA in connection with this Contract shall become the property of SEPTA; provided, however, the use, storage, reproduction, handling, disclosure and dissemination of any such materials shall be subject to this Article.
GC 16.6 Deliverables
In addition to the Licensed Technology, and the Licensed Software, and to the extent not otherwise included therein, the Contractor shall furnish to SEPTA, in the form(s) required by the Technical Specification, as-built drawings, parts lists, schematics, diagrams, manuals, other data, documents and information, including but not limited to all Systems, Subsystems, assemblies, subassemblies, components and interface systems and controls required by the Technical Specification for use by SEPTA for the Approved Purposes. The parties shall agree on procedures for verifying the completeness of each delivery, and at the time of the first delivery and each delivery thereafter, SEPTA and the Contractor shall jointly verify the deliverables in accordance with agreed-upon procedures.

GC 16.7 Delivery Schedule
In furtherance of the Licenses granted in this Article, the Contractor covenants that it shall deliver to SEPTA complete and current copies of all of the Licensed Technology, and the Licensed Software, as described in GC 16.6 - Deliverables, not later than the time that Contractor delivers the Pilot Vehicles. The Contractor shall deliver to SEPTA all corrections, modifications and upgrades (collectively, "updates") to the documentation of the Licensed Technology, and the Licensed Software previously delivered as soon as such updates become available, but no later than the date of delivery of the last Vehicle. Final updates shall be provided no later than eighteen (18) months after delivery of the last Vehicle. With this final delivery, the Contractor shall certify that SEPTA has received all Licensed Technology, and all Licensed Software representing the "as-built" Vehicles.

GC 16.8 Use of Agents
SEPTA may employ Agents for the Approved Purposes, as needed, and may sublicense its rights to use the Licensed Technology, and the Licensed Software to such Agents for the Approved Purposes; provided, however, that each such Agent (i) shall receive such sublicense only pursuant to a written agreement subjecting the Agent to the same restrictions on use and disclosure of the licensed property as SEPTA; and (ii) the Agent shall have no right to sublicense the licensed property, and (iii) except with respect to the Approved Purposes set forth in GC 16.1 – Technology License, the Agent shall not be a direct competitor of the Licensor.

GC 16.9 Software Warranty
In addition to any other requirements set forth in the Contract, the Contractor warrants that, for the period of the Warranty otherwise applicable hereunder, the software (including any Licensed software) shall; (i) be of a language that is commercially available in the United States and for which software tools are available; (ii) be capable of being copied by SEPTA (for the Approved Purposes); (iii) not contain viruses or pre-programmed devices or require use of any dongle or any adapter or any hardware or software device which will cause any software utilized by SEPTA to be erased or become inoperable or incapable of processing accurately or incapable of being copied by SEPTA; (iv) the software and each module and function thereof shall be capable of operating fully and correctly on the Vehicles and; (v) the software does not contain any code that will, upon the occurrence or the nonoccurrence of any event, disable the software. This Warranty shall not apply to any software modified by SEPTA without the approval of the Contractor.

GC 17. Federal, State, and local Contract Requirements

GC 17.1 Federal and State Requirements
The Contractor shall abide by all requirements attached hereto and made a part hereof in Section 5 - Federal and State Requirements for all the work performed in connection with the Contract.
GC 17.2 Compliance With Federal, State, and Local Laws
The Contractor shall comply with all applicable laws, ordinances, regulations, rules, standards and orders of Federal, State and Local governments or authorities (collectively, the “Applicable Laws”) in effect or which become effective during the term of the Contract. All Material and/or Equipment furnished hereunder shall comply with the provisions of said Applicable Laws.

The Contractor shall be responsible for compliance with all safety rules and regulations of the Federal Occupational Safety and Health Act of 1970 and those of all Applicable Laws during the conduct and performance of the Contract. The Contractor shall indemnify the SEPTA Parties against fines, penalties and corrective measures that result from or are required by any acts of commission or omission of the Contractor, Subcontractor(s), agents, employees and assignees and their failure to comply with such safety rules and regulations.

The Contractor shall give all notices and comply with all Applicable Laws bearing on the performance of the Contract, or concerning the production of the Bus and/or items of Material and/or Equipment thereunder, including, but not limited to, any laws referred to in the Contract Documents. Within five (5) days of receipt of a written request from SEPTA, the Contractor shall furnish to SEPTA certificates of compliance with all such Applicable Laws. The Contractor shall be responsible for obtaining all necessary permits and licenses required for performance under the Contract.

SEPTA shall consider issuing a Change Order for any Applicable Laws enacted after the date of the Best and Final Offer that actually modifies the Materials and/or Equipment, or the Bus themselves. Applicable Laws signed into law or issued prior to the date of the Best and Final Offer but with an effective date after the date of the Best and Final Offer shall be considered as having been enacted prior to the date of the Best and Final Offer.

GC 17.3 Prohibited Interest
No member, officer, or employee of SEPTA or of a local public body during his or her tenure or one year thereafter shall have any financial interest, direct or indirect, in the Contract or the proceeds thereof.

GC 18. Policies for Prime Contract

GC 18.1 Certifications Required
The Contractor agrees to comply with 49 U.S.C. § 5323(l) and FTA's implementing regulation at 49 C.F.R. Part 663.

GC 18.2 Buy America Requirements

GC 18.3 Federal Motor Vehicle Safety Standards (FMVSS)
The Contractor shall submit 1) manufacturer's FMVSS self-certification sticker information that the vehicle complies with relevant FMVSS or 2) manufacturer's certified statement that the contracted Buses will not be subject to FMVSS regulations.
GC 18.4  Bus Testing
The Contractor agrees to comply with 49 U.S.C. § 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 SEPTA prior to the recipient's final acceptance of the first Bus.

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 SEPTA prior to SEPTA's final acceptance of the first vehicle. If the configuration or components are not identical, the manufacturer shall provide a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing.

4. If the manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), the manufacturer shall provide the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

GC 19.  Taxes
The Contractor shall pay all sales, consumer, use and other taxes which it is by law required to pay.

Pennsylvania Sales and Use Tax:  As an agency and instrumentality of the Commonwealth of Pennsylvania, SEPTA is exempt from the payment of Federal Excise Taxes and Pennsylvania Sales and Use Taxes (71 P.S. Sec. 7071 et seq.) on material, equipment or other personal property purchases and contracts for its exclusive use or consumption: therefore, the Proposer shall not include these taxes in the computation of its price proposal. SEPTA will furnish exemption certificates, as required, upon the request of the Proposer.

City of Philadelphia and School District of Philadelphia Taxes:  The Proposer as a result of any contract entered into pursuant to this Request for Proposal, may be subject to certain business taxes imposed by the City of Philadelphia and/or the School District of Philadelphia. The Proposer is solely responsible for making its own investigation to determine whether or not it is subject to the above-mentioned city and school district taxes, and for paying any such tax if applicable. Proposers are hereby informed that SEPTA is obligated by law to furnish to the City of Philadelphia Department of Collections, upon its request, the name and address of any person or firm with whom it has a contract for goods and services. For information the following phone number is provided: Business and Earnings and School Income Tax (215) 686-6600.

GC 20.  Governing Law
All matters or claims arising out of, related to, or in connection with the Contract, the Project or the relationship between the parties shall be governed by and construed in accordance with the laws of the Commonwealth of Pennsylvania without giving effect to the principles of conflicts of laws of such state. All matters, disputes, claims, litigation, or proceedings of any nature whatsoever based upon, arising out of, under or in connection with the Contract, the Project or relationship between the parties shall be solely and exclusively brought, maintained, resolved, and enforced in the state or federal courts located in the City of Philadelphia, Pennsylvania, irrespective of any procedural rules or laws related to venue and forum non conveniens, including but not limited to any choices Contractor may have under any such rules or law. Contractor hereby expressly consents to the
jurisdiction of the state and federal courts located in the City of Philadelphia and hereby expressly and irrevocably waives any objection which Contractor may have or hereafter may have to jurisdiction or venue in the state and federal courts located in the City of Philadelphia and any claim that such court is inconvenient or lacks personal jurisdiction over Contractor. Contractor represents and acknowledges that the choice of jurisdiction and venue described above is reasonable and has been freely and voluntarily made by Contractor. Further, the choice of jurisdiction and venue described above shall be mandatory and not permissive in nature, thereby precluding the possibility by Contractor of litigation or trial in any other jurisdiction, court or venue other than specified above, except that any final judgment may be enforced in other jurisdictions in any manner provided by law.

**GC 21. Personnel Security Measures**

SEPTA reserves the right to impose personnel security measures upon the Contractor and its employees as SEPTA deems necessary and appropriate to ensure the safety of its patrons, employees and property. These measures may include, but are not limited to, registration of all employees of the Contractor and its subcontractors who shall be working on SEPTA property, photo identification of all registered employees, and background investigations of all registered employees. In addition, SEPTA reserves the right to institute personnel security measures, which may be imposed at anytime during the course of the Work. SEPTA shall assume the costs of such security measures. The Contractor and its employees shall cooperate fully with SEPTA in implementing and enforcing security measures on SEPTA property. The Contractor shall be notified by SEPTA, in writing, regarding what is required by SEPTA to carry out any personnel security measures that are being imposed on the Contractor.

**GC 22. Labels**

The Contractor shall not place its name, stencil, stamping, or marking of any type as advertisement on any of the merchandise other than concealed trademarks or trade names normally installed by the Contractor.

**GC 23. Use of “SEPTA” Name in Contractor Advertising or Public Relations**

The Contractor shall not allow any information and/or material of any kind whatsoever related to the Contract to be used in the Contractor's advertisements or public relations programs until submitting the said material to SEPTA in advance and receiving prior written approval from SEPTA. The Contractor covenants and agrees that any published information on the Contract permitted by SEPTA shall be factual and in no way imply endorsement of the Contractor's firm, service, or product by SEPTA.

**GC 24. Integration**

Subject to SEPTA's right to rely upon substantial representations made by the Contractor in making the decision to award the Contract to Contractor, the Contract represents the entire and integrated agreement between SEPTA and Contractor and supersedes all prior or contemporaneous negotiation, representation, or agreement, either written or oral.

**GC 25. Severability**

If any paragraph, clause, section or part of the Contract is held or declared to be void or non-enforceable for any reason, all other paragraphs, clauses, sections or parts shall nevertheless continue in full force and effect.
GC 26. Contract Option
SEPTA, at its sole discretion, shall have the right to exercise the option(s) as listed in Appendix 2. If SEPTA exercised the option(s), the Notice to Proceed for the option(s) will not be given by SEPTA to the Contractor until, and is contingent upon, SEPTA's receipt of any required insurance certificates as set forth in GC 11.1 – Commercial General Liability Insurance, plus additional Performance Bond as set forth in GC 12.1 and Maintenance (Warranty) Bond as set forth in GC 12.2. Any necessary and required revisions to Insurance, Performance Bond, and/or Maintenance Bond must be submitted to SEPTA by the Contractor within ten (10) calendar days of SEPTA's written notice of its decision to exercise the option(s). The Performance Bond shall be effective from the award date of the option until the date of completion of the last option Bus, provided, however, that thirty (30) days after acceptance or conditional acceptance of the final Bus of the option, the Contractor may substitute a Maintenance (or Warranty) Bond in the amount specified above.

GC 27. Price Adjustment for Third (3rd), Fourth (4th), and Fifth (5th) Year of Order
In the 3rd, 4th and 5th production years, the unit price for 40-foot diesel-electric hybrid buses, as set forth in Appendix 2, shall be adjusted. Note that the “3rd year” represents expected deliveries during 2018, the “4th year” represents expected deliveries during 2019, and the “5th year” represents expected deliveries during 2020. The price will be adjusted as follows:

Hybrid Bus Price Adjustment:
The Hybrid Bus price adjustment will consist of two terms, consistent with proposal pricing: (1) the base Diesel Bus Price component, which will be adjusted using the Diesel Bus Price Adjustment PPI, plus (2) the Hybrid Alternative Price incremental component, which will be adjusted using a different PPI. Hence, the Diesel Bus Price component will be adjusted using PPI: 1413 – Truck and Bus Bodies. However, as stated, the Hybrid Alternative Price incremental component will be adjusted using PPI: 14120503 – Motor Vehicle Transmission and Power Train. In the example below, the formula illustrates the price adjustment for Hybrid Buses.

For Third (3rd) Year Guaranteed and Option Buses:

\[(\text{Diesel Base-Unit Price}) \times (\text{PPI for March 2018}) \div (\text{PPI for Month of Contract Notice to Proceed})\]  
\[\text{PLUS}\]  
\[(\text{Hybrid Alternative Incremental Unit Price}) \times (\text{PPI for March 2018}) \div (\text{PPI for month of Contract Notice to Proceed})\]  
\[= \text{ADJUSTED PRICE}\]

For Fourth (4th) Year Guaranteed and Option Buses:

\[(\text{Diesel Base-Unit Price}) \times (\text{PPI for March 2019}) \div (\text{PPI for Month of Contract Notice to Proceed})\]  
\[\text{PLUS}\]  
\[(\text{Hybrid Alternative Incremental Unit Price}) \times (\text{PPI for March 2019}) \div (\text{PPI for month of Contract Notice to Proceed})\]  
\[= \text{ADJUSTED PRICE}\]
For Fifth (5th) Year Guaranteed and Option Buses:

\[
\text{(Diesel Base-Unit Price) } \times \text{(PPI for March 2020)} \times \text{(PPI for Month of Contract Notice to Proceed)}
\]

PLUS

\[
\text{(Hybrid Alternative Incremental Unit Price) } \times \text{(PPI for March 2020)} \times \text{(PPI for month of Contract Notice to Proceed)}
\]

= ADJUSTED PRICE

Note: For any adjustment, all Producer Price Index data used for the Price Adjustment calculations shall be “Not Seasonally Adjusted” data. Preliminary PPI Index Numbers shall not be used for any calculation.

GC 28. Assignability
If SEPTA does not exercise the option(s) as listed in GC 26 – Contract Option, SEPTA reserves the right to assign the option(s) to other grantees of Federal Transit Administration (FTA) funds in accordance with FTA Circular 4220.1F.

FTA's policy is that the original solicitation must contain an express notification to all bidders that an assignment would be possible under the terms of the contract. Such a notification would put the bidders on notice that they would likely be called upon to deliver all of the deliverable items, both the base as well as the option quantities. The assignment clause would thus be an important factor in the original competitive bidding. If the contract does not contain an express assignability clause, piggybacking is not permitted.

GC 29. Joint and Several Liability (If Applicable)
The liability of _________________ to comply with the terms of this Contract including, but not limited to, the Contract Documents set forth in Section__________ shall be joint and several and all notices, payments and agreements given or made by, with or to any one of such corporations shall be deemed to have been given or made by, with or to all of them.
IN WITNESS WHEREOF, the parties hereto have caused the Contract to be executed by the undersigned duly authorized officers, under seal, as of the day and the year first above written.

ATTEST: SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY

__________________________________ ______________________________________
(Secretary) General Manager

SEAL

ATTEST: <NAME OF CONTRACTOR>

By: ________________________________ By: ________________________________
*(Asst.) Secretary or *(Asst.) Treasurer *President or *Vice President
Typed Name: _________________________ Typed Name: __________________________

[CORPORATE SEAL] * Cross out the inappropriate titles and if signed by some other officer, attach a power of attorney or certified Board Resolution authorizing such signature.

APPROVED AS TO FORM:

By: _____________________________, Esq.
Office of General Counsel
Southeastern Pennsylvania Transportation Authority
SECTION 4

SPECIAL PROVISIONS
SECTION 4: SPECIAL PROVISIONS

SP 1. Pilot Bus

SP 1.1 Pilot Inspection Specific Requirements

SP 1.1.1 Pilot Vehicle General Requirements

SP 1.1.2 Documentation

SP 1.1.3 Engineering Design Review and Production Program

SP 1.1.3.1 Purpose

SP 1.1.3.2 Conferences

SP 1.1.3.3 Specification Review Meeting

SP 1.1.3.4 Schedule(s)

SP 2. Project Schedule
SECTION 4: SPECIAL PROVISIONS

SP 1. Pilot Bus

SP 1.1 Pilot Inspection Specific Requirements

One (1) pilot inspection shall be obtained under this specification and where modified by applicable parts of § 6 40’ LOW FLOOR DIESEL-ELECTRIC HYBRID BUS TECHNICAL SPECIFICATION as follows:

1. First (1st) pilot inspection due prior to first production bus (At least one pilot bus shall be required for each vehicle configuration).

The construction of the Pilot Vehicle shall precede that of the remaining vehicles in all stages. The manufacture of other vehicles for the SEPTA order is strictly prohibited until all discrepancies are resolved on the PILOT vehicle. As the PILOT vehicle construction proceeds, a thorough inspection of the vehicle shall be made at the completion of manufacturing at each work station in the assembly process by SEPTA's Resident Inspector. Once the PILOT vehicle is completed, SEPTA shall have no less than 90 days to inspect all aspects of this vehicle for compliance with the Specification. Specification compliance shall be verified utilizing Configuration Audits, Documentation, Certifications and Performance Tests as required by Section 6: Technical Specification. During this 90 day period, SEPTA may use this vehicle in revenue service. After the 90 day period of vehicle review is completed by SEPTA and all discrepancies resolved and approved by SEPTA, the Contractor may commence construction of the remaining buses in this order. SEPTA, at its sole discretion, may terminate this review in a few as 50 days if the Pilot bus is able to perform revenue service for thirty (30) consecutive days without experiencing a failure.

Upon acceptance of the PILOT INSPECTION Vehicle by SEPTA, the Contractor shall be permitted to begin construction of the remaining buses. The PILOT bus shall be returned to the Contractor’s facility and must remain at that facility and be available to both plant and SEPTA personnel for use in comparing this bus to others for the purpose of determining compliance with the Specification.

Multi-year, multiple yearly delivery Contracts wherein the Contractor changes, modifies, improves, alters, combines or substitutes any material, component or system with or without SEPTA’s permission or advance knowledge thereof, said circumstance shall, at SEPTA’s sole discretion, permit SEPTA to implement a PILOT VEHICLE PROGRAM as defined herein and by addenda. Further, SEPTA may reject any change(s), modification, improvement, alteration, combination thereof or substitution(s) of any material, component or system not approved by SEPTA at the first pilot inspection.

2. It is the intention of SEPTA to empower all major sub-component manufacturers (Subcontractors). Therefore, prior to submitting the PILOT INSPECTION Vehicle to SEPTA for inspection and approval, the Contractor shall secure endorsements from the following sub-component manufacturers. Application references shall be supplied to SEPTA engineering at the first pre-production meeting. Endorsements to be delivered to SEPTA fourteen (14) business days prior to the delivery of the PILOT INSPECTION Vehicle. The Subcontractors shall provide a written report in the form of a notarized letter from an officer of the company that all components and systems are properly applied,
installed and shall operate as designed for their intended service life on the vehicle. The following is a list of required endorsements:

**A.** The Engine equipment supplier shall furnish all required application based testing and Cummins IQA testing. All required certifications. Engine Assembly and all related components, including:

1. Engine cradle and chassis mounting.
2. Cooling system - fan drive system, include radiator and maintainability issues.
3. Air induction system.
4. Wiring harness and development.
5. Hydraulic pumps and hose routing and development-all high pressure hose data/application criteria.
6. The Engine/Propulsion sub-supplier shall furnish a report detailing full compliance with Septa’s specification requirements including but not limited to single point sensor controls, physical arrangement of equipment and general maintainability.
7. Maintainability of exhaust after treatment unit-all subcomponent supplies-separate endorsements. Proposer(s)/subsystem supplier(s) to furnish maintainability demonstration plan with proposal. Demonstration plan defines specification fidelity, physical or actual system mock up, engineer plan and other sundry items attending pathway and verification of specification compliance.
8. Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.

**B.** Propulsion system.
1. Traction generator or combined unit
2. Traction motor or combined unit
3. Propulsion inverter(s)
4. Propulsion controller(s) vehicle to system and system to system sub-controllers
5. Propulsion controller interface devices, SCADA and power cabling
6. ESS, Battery pack(s), high voltage connection cabling, recycling cost estimate/recycling Contractor list.
7. Propulsion system cooling package-fully integrated controls.
8. Auxiliary inverter/converter.
9. Hydraulic (glycol and oil based) Septa specification compliance and subsystem endorsement.
10. Propulsion sub-supplier shall furnish a report detailing full compliance with Septa’s specification requirements including but not limited to single point sensor controls, physical arrangement of equipment and general maintainability.
11. Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.

**C.** Rear Axle, middle or tag axle manufacturer.

**D.** Front Axle manufacturer.

**E.** HVAC System. Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.

**F.** Wheel Chair Lift Assembly or ramp.

**G.** Entrance and Exit Door Systems. Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.

**H.** Electrical Multiplexing System, data networks (Contractor) Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.
I. Auxiliary Heating System. Shall supply 60 month repair history (2 component supplier at proposal) Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.

J. Destination Sign(s) Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.

K. Automatic Stop Announcement System primary Contractor. Compliance statements for all applicable § 6 Technical specification including but not limited to TS9.9.7.5.

No endorsement shall be complete or attained without a full system functional test and demonstration at Pilot. No system functional test can proceed without a completed document package including all interconnection schematics, single line diagrams, full function descriptions for all interconnected devices including the furnishing of a full/all functional system flow chart, a complete list for all device programs and all tools and equipment required to audit the functionality of the system. The AVL/M contractor shall arrange training for Septa engineering staff prior to the delivery of the Pilot bus. The contractor shall provide necessary discreet and CAN messaging emulation needed to source all required signals for 3rd party audit check. Training provided shall be sufficient in scope to inform test engineers of system operation, methods and approaches, test tools and PC based tools required for Pilot testing.

L. Reserved

M. PC Based Laptop Computers, Software and Interface Devices.

N. Interior Lighting.

O. Passenger Counter

P. Fuel Focus System

All testing needed to obtain certifications and endorsements must be completed prior to presenting the vehicle for SEPTA review, and as defined by K. Any test performed may be witnessed by a SEPTA representative. A complete test plan must be submitted to SEPTA at least 15 working days prior to the scheduled test for review and approval. No test or result obtained shall be considered valid without prior submission and approval of plan by SEPTA.

Upon acceptance of the PILOT INSPECTION Vehicle by SEPTA, the Contractor shall be permitted to begin construction of the remaining buses. The PILOT bus shall be returned to the Contractor’s facility and must remain at that facility and be available to both plant and SEPTA personnel for use in comparing this bus to others for the purpose of determining compliance with the Specification.

SP 1.1.1 Pilot Vehicle General Requirements

SEPTA's Quality Control Resident Inspector shall have the rights offered in Section 8 - Quality Assurance, herein for subassemblies or whole assemblies whenever these do not conform to the pilot vehicle mutually agreed to in writing. The Contractor shall submit their manufacturing layout, total documentation (forms) which control their quality control inspections during manufacture of the vehicles.

i) A report on defects found and proposed solutions will be submitted to SEPTA's Resident Inspector(s). Tests will be repeated until a defect free 50 mile road test is competed.

ii) In addition to the pilot vehicle, each manufactured vehicle and shall complete a defect free 15 mile road test prior to shipment to SEPTA. A full load is not required for this road test.
SP 1.1.2 Documentation
Drawings sufficient in detail to define the bus, schematics and system descriptions shall be submitted and approved prior to the manufacture of Pilot Bus. Two draft maintenance manuals, parts manuals and bill of material shall be provided with the Pilot Bus to conduct “as built” audits and vehicle systems verifications. Schematics, base drawings shall also be provided with the Pilot Bus.
The Contractor shall provide, or shall at Septa’s request provide, engineering and manufacturing assets (engineering and manufacturing personnel), documentation and facilities required to complete said tasking as described herein and throughout this Pilot phase, general production of buses required to prove the specification directed and contract functional outcomes and features.
All as built drawings, schematics and documentation related to functional systems and components shall be organized to show the physical layer representation juxtaposed by the virtual or process instruction explaining the operation of said physical system. That is; all electrical, hydraulic, pneumatic and other bus system component documentation shall contain full system operational descriptions for real and virtual operations.
The aforementioned includes all virtual instructions including CAN telegrams, masking instructions and network process functions.

SP 1.1.3 Engineering Design Review and Production Program

SP 1.1.3.1 Purpose
The Engineering Design and Production Review Program is a multi-purpose program that will cover design concept and arrangement drawings of the vehicle, the engineering and production drawings, performance and design calculations and supporting drawings to reflect the Contractor’s design and understanding of the technical specifications.

SP 1.1.3.2 Conferences
The Project Manager shall select the location for Vehicle Design and Specifications Review Meetings. The meetings, which will in general be held in Philadelphia until completion of mock-ups, if any, or the construction commences on the Pilot and Production buses unless mutually agreed upon for an alternate location.

SP 1.1.3.3 Specification Review Meeting
In order to ensure that the Contractor fully understands the detailed intent of the Contract Documents in all areas, the Contractor shall arrange for sufficient number of engineering meetings to be held and mutually agreed to schedule after the Notice to Proceed is issued. These meeting(s) shall be held at the SEPTA office in Philadelphia and shall be attended by representatives of the Contractor, major Subcontractors if necessary or SEPTA so requests. At these meetings the entire technical portion of the Contract Documents shall be reviewed in depth in such a manner as to leave no doubt as to the intent of the technical specification(s) in each and every area of design, construction and testing of the buses. Minutes of the Conference will include each and every understanding and agreement reached and item(s) discussed. After concurrence by all parties, the minutes of the conference shall become a guiding document in any areas of the Contract Documents where the intent may not be fully clear. No change shall be made to any provision of the Contract during these meetings.
SP 1.1.3.4 Schedule(s)

The Contractor shall provide a production forecast for the Pilot Bus, Production Buses and all deliverables for review during the meetings. The schedule(s) will be updated for each meeting or every 30 days and delivered to Project Manager in accordance with Section 3 – Contract and General Conditions, GC 2.7 - Time of Performance.

SP 2. Project Schedule

Delivery of the buses to be in accordance with the following Project Schedules:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delivery of 1st Pilot (40 ft.) Diesel-Electric Hybrid Bus</td>
<td>120 days prior to start of CY 2016 deliveries of 40 ft. Low Floor Diesel-Electric Hybrid Bus.</td>
</tr>
<tr>
<td>2</td>
<td>Delivery of 1st group 89 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2016</td>
<td>Between 300 Days Minimum and 480 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>3</td>
<td>Delivery of 2nd group 105 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2017</td>
<td>Between 600 Days Minimum and 780 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>4</td>
<td>Delivery of 3rd group 100 (40 ft.) Diesel-Electric Hybrid Production buses guaranteed for CY 2018</td>
<td>Between 960 Days Minimum and 1,160 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>5</td>
<td>Delivery of 4th group 115 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2019</td>
<td>Between 1,260 Days Minimum and 1,460 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>6</td>
<td>Delivery of 5th group 115 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2020</td>
<td>Between 1,620 Days Minimum and 1,820 Days Maximum after Notice to Proceed Date.</td>
</tr>
</tbody>
</table>

*Example: If Notice to Proceed (GC 2.7) is given to a contractor on October 1, 2015, production buses for calendar year 2016 would have to completely delivered to SEPTA between 7/27/2016 and 1/23/2017 in order to avoid Liquidated Damages in accordance with GC 7.3.

Note 1 – For any yearly option order, the Contractor will be notified in writing 190 days prior to the respective scheduled delivery period. The written notification will be for:

<table>
<thead>
<tr>
<th>Calendar Year Delivery</th>
<th>Guaranteed Quantity</th>
<th>Non-Guaranteed Option Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>105</td>
<td>10</td>
</tr>
<tr>
<td>2018</td>
<td>100</td>
<td>15</td>
</tr>
<tr>
<td>2019</td>
<td>115</td>
<td>0</td>
</tr>
<tr>
<td>2020</td>
<td>115</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>525</td>
<td>25</td>
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SECTION 5

FEDERAL AND STATE

CONTRACT REQUIREMENTS
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<td>SR 7 - Contractor Responsibility</td>
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</table>
SECTION 5: FEDERAL REQUIREMENTS

FR 1 - Access to Records
The Contractor agrees to maintain all books, records, accounts and reports required under this Contract for a period of not less than three years after the date of termination or expiration of this Contract, except in the event of litigation or settlement of claims arising from the performance of this Contract, in which case Contractor agrees to maintain same until the Agency, the FTA Administrator, the Comptroller General or any of their duly authorized representatives have disposed of all such litigation, appeals, claims or exceptions related thereto. Reference 49 CFR 18.39(i)(11).

The following access to records requirements apply to this Contract:

FR 1.1 Local Governments
In accordance with 49 CFR 18.36(i), the Contractor agrees to provide the Agency, the FTA Administrator, the Comptroller General of the United States or any of their authorized representatives access to any books, documents, papers and records of the Contractor that are directly pertinent to this Contract for the purposes of making audits, examinations, excerpts and transcriptions. Contractor also agrees, pursuant to 49 CFR 633.17 to provide the FTA Administrator or his authorized representatives including any PMO Contractor access to Contractor’s records and construction sites pertaining to a major capital project, defined at 49 USC 5302(a)1, which is receiving federal financial assistance through the programs described at 49 USC 5307, 5309 or 5311.

FR 1.2 State Governments
In accordance with 49 CFR 633.17, the Contractor agrees to provide the Agency, the FTA Administrator or his 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, which 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 $100,000.

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

The Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the Master Agreement between Agency and FTA, as they may be amended or promulgated from time to time during the term of this Contract. Contractor’s failure to so comply shall constitute a material breach of this Contract.
FR 3 - Federal Energy Conservation Requirements
The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency that are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

FR 4 - Civil Rights Requirements
The following requirements apply to the underlying Contract:

1. **Nondiscrimination:** In accordance with Title VI of the Civil Rights Act, as amended, 42 USC § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 USC § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 USC § 12132, and Federal transit law at 49 USC § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

2. **Equal Employment Opportunity:** The following equal employment opportunity requirements apply to the underlying Contract:

   (a) **Race, Color, Creed, National Origin, Sex:** In accordance with Title VII of the Civil Rights Act, as amended, 42 USC § 2000e, and Federal transit laws at 49 USC § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor,” 41 CFR Parts 60 et seq., (which implement Executive Order No. 11246, “Equal Employment Opportunity,” as amended by Executive Order No. 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” 42 USC § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

   (b) **Age:** In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 USC §§ 623 and Federal transit law at 49 USC § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

   (c) **Disabilities:** In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 USC § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, “Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act,” 29 CFR Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

3. The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.
FR 5 - No Government Obligation to Third Parties

1. The Agency and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the Solicitation or award of the underlying Contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this Contract and shall not be subject to any obligations or liabilities to the Agency, Contractor, or any other party (whether or not a party to that Contract) pertaining to any matter resulting from the underlying Contract.

2. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clause shall not be modified, except to identify the Subcontractor who will be subject to its provisions.

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

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

2. The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a Contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 USC § 5307, the Government reserves the right to impose the penalties of 18 USC § 1001 and 49 USC § 5307(n)(1) on the Contractor, to the extent the Federal Government deems appropriate.

3. The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the Subcontractor who will be subject to the provisions.

FR 7 - Suspension and Debarment

This Contract is a covered transaction for purposes of 49 CFR Part 29. As such, the Contractor is required to verify that none of the Contractor, its principals, as defined at 49 CFR 29.995, or affiliates, as defined at 49 CFR 29.905, are excluded or disqualified as defined at 49 CFR 29.940 and 29.945.

The Contractor is required to comply with 49 CFR 29, Subpart C, and must include the requirement to comply with 49 CFR 29, Subpart C, in any lower-tier covered transaction it enters into.

By signing and submitting its bid or Proposal, the Bidder or Proposer certifies as follows:

The certification in this clause is a material representation of fact relied upon by SEPTA. If it is later determined that the Bidder or Proposer knowingly rendered an erroneous certification, in addition to remedies available to SEPTA, the federal government may pursue available remedies, including but not limited to suspension and/or debarment. The Bidder or Proposer agrees to comply with the requirements of 49 CFR 29, Subpart C, while this
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 Title 49, Code of Federal Regulations, Part 26, Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs.

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

The Contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this Contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of this DOT-assisted Contract. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as SEPTA 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 assure notification to FTA and the appropriate EPA Regional Office.

2. The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

**FR 10 - Clean Air Requirements**

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 USC §§ 7401 et seq. The Contractor agrees to report each violation to the Agency and understands and agrees that the Agency will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.

2. The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

**FR 11 - Compliance with Federal Lobbying Policy**

Contractors who apply or bid for an award of $100,000 or more shall file the certification required by 49 CFR Part 20, “New Restrictions on Lobbying.” Each tier certifies to the tier above that it will not and has not used federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any Agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any federal Contract, grant or any other award covered by 31 USC 1352. Each tier shall also disclose the name of any registrant under the Lobbying Disclosure Act of 1995 who has made lobbying contacts on its behalf with non-federal funds with respect to that federal Contract, grant or award covered by 31 USC 1352. Such disclosures are forwarded from tier to tier up to the recipient.
FR 12 - Buy America
The Contractor agrees to comply with 49 USC 5323(j) and 49 CFR Part 661, which provide that federal funds may not be obligated unless steel, iron and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR 661.7. A general public interest waiver from the Buy America requirements applies to microprocessors, computers, microcomputers, software or other such devices, which are used solely for the purpose of processing or storing data. This general waiver does not extend to a product or device that merely contains a microprocessor or microcomputer and is not used solely for the purpose of processing or storing data.

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

A 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 that are 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 A 5323(c) and FTA’s implementing regulation at 49 CFR Part 665 and shall perform the following:

1. A manufacturer of a new bus model or a bus produced with a major change in components or configuration shall provide a copy of the final test report to the recipient at a point in the procurement process specified by the recipient, which will be prior to the recipient’s final acceptance of the first vehicle.

2. A manufacturer who releases a report under Paragraph 1 above shall provide notice to the operator of the testing facility that the report is available to the public.

3. If the manufacturer represents that the vehicle was previously tested, the vehicle being sold should have the identical configuration and major components as the vehicle in the test report, which must be provided to the recipient prior to recipient’s final acceptance of the first vehicle. If the configuration or components are not identical, the manufacturer shall provide a description of the change and the manufacturer’s basis for concluding that it is not a major change requiring additional testing.

4. If the manufacturer represents that the vehicle is “grandfathered” (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), the manufacturer shall provide the name and address of the recipient of such a vehicle and the details of that vehicle’s configuration and major components.

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) component and subcomponent parts of the rolling stock to be purchased identified by manufacturer of the parts, their country of origin
and costs; and (2) the location of the final assembly point for the rolling stock, including a description of the activities that will take place at the final assembly point and the cost of final assembly.

2. **Solicitation specification requirements:** The Contractor shall submit evidence that it will be capable of meeting the bid specifications.

3. **Federal Motor Vehicle Safety Standards (FMVSS):** The Contractor shall submit (1) manufacturer’s FMVSS self-certification, Federal Motor Vehicle Safety Standards, that the vehicle complies with relevant FMVSS or (2) 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 fifty (50) percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners and tankers) involved, whenever shipping any equipment, material or commodities pursuant to the underlying Contract to the extent such vessels are available at fair and reasonable rates for U.S.-flag commercial vessels;
- To furnish within twenty (20) working days following the date of loading for shipments originating within the United States or within thirty (30) working days following the date of leading for shipments originating outside the United States, a legible copy of a rated, “on-board” commercial ocean bill of lading in English for each shipment of cargo described in the preceding paragraph to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the FTA recipient (through the Contractor in the case of a Subcontractor’s bill-of-lading.)
- To include these requirements in all subcontracts issued pursuant to this Contract when the subcontract may involve the transport of equipment, material or commodities by ocean vessel.

**FR 16 - Fly America**

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

**FR 17 - Contract Work Hours And Safety Standards**

A. **Overtime requirements** - No Contractor or subcontractor contracting for any part of the Contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

B. **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 therefor shall be
liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (A) of this section.

C. **Withholding for unpaid wages and liquidated damages** – SEPTA shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (B) of this section.

D. **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 Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (A) through (D) of this section.

**FR 18 - Accessibility**

SECTION 5 – STATE CONTRACT REQUIREMENTS

SR 1 - Nondiscrimination Clause.

A. In the hiring of any employee(s) for the manufacture of supplies, performance of work, or any other activity required under the Contract or any subcontract, the Contractor, subcontractor, or any person acting on behalf of the Contractor or subcontractor shall not, by reason of gender, race, creed, or color, discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.

B. Neither the Contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate against or intimidate any employee involved in the manufacture of supplies, the performance of work, or any other activity required under the Contract on account of gender, race, creed, or color.

C. Contractor and subcontractors shall establish and maintain a written sexual harassment policy and shall inform their employees of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined.

D. Contractor shall not discriminate by reason of gender, race, creed, or color, against any subcontractor or supplier who is qualified to perform the work to which the Contract relates.

E. The Contractor and each subcontractor shall furnish all necessary employment documents and records to and permit access to their books, records, and accounts by the contracting agency and the Bureau of Contract Administration and Business Development, for purposes of investigation, to ascertain compliance with provisions of this Nondiscrimination/Sexual Harassment Clause. If the Contractor or any subcontractor does not possess documents or records reflecting the necessary information requested, the Contractor or subcontractor shall furnish such information on reporting forms supplied by SEPTA or the Bureau of Contract Administration and Business Development.

F. The Contractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subcontract so that such provision will be binding upon each subcontractor.

G. The Commonwealth or SEPTA may cancel or terminate the Contract, and all money due or to become due under the Contract may be forfeited for a violation of the terms and conditions of this Nondiscrimination/Sexual Harassment Clause. In addition, the Commonwealth and/or SEPTA may proceed with debarment or suspension and place a record of the action regarding the Contractor in the Commonwealth Contractor Responsibility Files.
SR 2 - Air Pollution and Environmental Protection.

The Contract is subject to the provisions of the Air Pollution Control Act of 1960, as amended (35 P.S. 4001, et seq.) and any rules, regulations or orders issued by the Pennsylvania Department of Environmental Resources under the provisions of that Act.

SR 3 - Additional Work Due to Changes in Environmental Protection Requirements.

a. For purposes of this Paragraph 3., "Environmental Laws" shall mean the provisions of the Air Pollution Control Act of 1960, as amended (35 P.S. 4001, et seq.), and any rules, regulations or orders issued by the Pennsylvania Department of Environmental Resources under the provisions of that Act.

b. If the Contractor must undertake additional work due to the enactment of new or the amendment of existing Environmental Laws occurring after the submission of the successful bid, SEPTA shall issue a change order setting forth the additional work that must be undertaken which shall not invalidate the Contract. The cost of such a change order to SEPTA shall be determined in accordance with the provisions of Paragraph XIV. of the Agreement; provided, however, that such additional costs to undertake work not specified in the invitation for bid shall not be approved unless written authorization is given the Contractor prior to its undertaking such additional activity. In the event of a dispute between SEPTA and the Contractor, arbitration procedures may be commenced under the applicable terms of the construction contract, or, if the contract contains no such provision for arbitration, the then obtaining rules of the American Arbitration Association.

SR 4 - Steel Products

All steel products used or supplied in the performance of the Contract shall be products produced from steel made in the United States in conformity with the Steel Products Procurement Act of 1978 (Act No. 3 of 1978, March 3, P.L. 6 (73 P.S. 1881 et seq.)), as amended, and if the federal Buy America Requirements are applicable to the Contract, in full conformity with the Buy America provisions of Section 165(a) of the Federal Surface Transportation Assistance Act of 1982, as amended, and the applicable regulations in 49 CFR Part 661.

Contractor shall insert this requirement as a special condition for any subcontract awarded under the Contract.

SR 5 - Reporting of Political Contributions

Contractor shall comply with the applicable provision of 25 PS §3260a. hereinafter set forth:

1. Any business entity including but not limited to a corporation, association, partnership or sole proprietorship, which has been awarded non-bid contracts from the Commonwealth or its political subdivisions during the preceding calendar year, shall report by February 15 of each year to the
Secretary of the Commonwealth an itemized list of all political contributions known to the business entity by virtue of the partner or individual owner that has been made by:

a. any officer, director, associate, partner, limited partner, individual owner or members of their immediate family; or

b. any employee or members of his immediate family whose political contribution exceeded one thousand dollars ($1,000) during the preceding year.

For the purposes of this subsection, "immediate family" means a person's spouse and any unemancipated child.

2. It shall be the duty of the Secretary of the Commonwealth to publish sixty (60) days after February 15 of each year a complete itemized list of all contributions given under the provisions of subsection 1. This list shall be a matter of public record open to public inspection and copies made available at cost to any individual who requests them.

**SR 6 - Membership in Clubs**

In accordance with Chapter 17-400 of the Philadelphia Code, Contractor agrees with its payment or reimbursement of membership fees or other expenses associated with participation by its employees in an exclusionary private organization, insofar as such participation confers an employment advantage or constitutes or results in discrimination with regard to hiring, tenure of employment, promotions, terms, privileges or conditions of employment on the basis of race, color, sex, sexual orientation, religion, national origin or ancestry, constitutes a substantial breach of the Agreement entitling SEPTA to all rights and remedies provided in the Agreement or otherwise available in law or equity.

Contractor agrees to include the immediately preceding paragraph, with appropriate adjustments for the identity of the parties, in all subcontracts which are entered into after the date of the Agreement for services to be performed pursuant to the Agreement.

**SR 7 - Contractor Responsibility.**

For the purpose of these provisions, the term “Contractor” is defined as any person, including, but not limited to, a proposer, offeror, loan recipient, grantee, or subgrantee, who has furnished or seeks to furnish goods, supplies, services, or leased space, or who has performed or seeks to perform construction activity under contract, subcontract, grant, or subgrant with the Commonwealth, or with a person under institutions. The term “Contractor” may include a permittee, licensee, or any agency, political subdivision, instrumentality, public authority, or other entity of the Commonwealth.

1. The Contractor must certify, in writing, for itself and all its subcontractors, that as of the date of its execution of any Commonwealth contract, that neither the Contractor, nor any subcontractors, nor any suppliers are under suspension or debarment by the Commonwealth or any governmental entity, instrumentality, or authority and, if the Contractor cannot so certify, then it agrees to submit, along with the bid/proposal, a written explanation of why such certification cannot be made.

2. The Contractor must also certify, in writing, that as of the date of its execution of any Commonwealth contract, it has no tax liabilities or other Commonwealth obligations.
3. The Contractor’s obligations pursuant to these provisions are ongoing from and after the effective date of the contract through the termination date thereof. Accordingly, the Contractor shall have an obligation to inform the contracting agency if, at any time during the term of the contract, it becomes delinquent in the payment of taxes, or other Commonwealth obligations, or if it or any of its subcontractors are suspended or debarred by the Commonwealth, the federal government, or any other state governmental entity. Such notification shall be made within 15 days of suspension or debarment.

4. The failure of the Contractor to notify the contracting agency of its suspension or debarment by the Commonwealth, any other state, or the federal government shall constitute an event of default of the Contract with the Commonwealth.

5. The Contractor agrees to reimburse the Commonwealth for reasonable costs of investigation incurred by the Office of the Inspector General for investigations of the Contractor’s compliance with the terms of this or any other agreement between the Contractor and the Commonwealth, which results in the suspension or debarment of the Contractor. Such costs shall include, but shall not be limited to, salaries of investigators, including overtime; travel and lodging expenses; and expert witness and documentary fees. The Contractor shall not be responsible for investigative costs for investigations which do not result in the Contractor’s suspension or debarment.

6. The Contractor may obtain the current list of suspended and debarred Commonwealth Contractors by either searching the Internet at [http://www.dgs.state.pa.us/debarment.htm](http://www.dgs.state.pa.us/debarment.htm) or contacting the:

   Department of General Services
   Office of Chief Counsel
   603 North Office Building
   Harrisburg, PA 17125
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SECTION 6: 40’ LOW FLOOR DIESEL-ELECTRIC HYBRID BUS TECHNICAL SPECIFICATION

GENERAL

TS 1. Scope

Technical Specifications define requirements for a heavy duty, forty foot (40’) low floor diesel electric hybrid transit bus which, by the selection of specifically identified alternative configurations, may be used for both suburban express service and general service on urban arterial streets. It shall have a minimum design life of 12 years or 500,000 miles and is intended for the widest possible spectrum of passengers, including children, adults, the elderly, and persons with disabilities. The bus shall by design and proper application of same ensure maximum environmental comfort to passengers and operators, while insuring the lowest possible per unit maintenance cost, and by design, materials selection and application ensure the lowest impact to environment as measured by service functionality and systems approach. The forty foot (40’) low floor diesel electric hybrid transit bus specified herein shall maximize the reduction of diesel fuel consumption and consequent emissions to the extent that the selected technology can facilitate. The buses shall comply with all applicable requirements of the CFR Title 49, The Commonwealth of Pennsylvania and FMVSS, NHTSA, ADA and EPA regulations and other codes and conventions specified herein, in effect at the time that vehicles are manufactured pursuant to this Contract.

TS 2. Definitions

The following are definitions of special terms used in Section 6.

Ambient Temperature. The temperature of the surrounding air. For testing purposes, ambient temperature must be between (0.0° F) and (+110° F).

Analog Signals. A continuously-variable signal that is solely dependent upon magnitude to express information content. Note: Analog signals are used to represent the state of variable devices such as rheostats, potentiometers, temperature probes, etc.

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

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

Battery Management System (BMS)-High Voltage. Monitors energy, as well as temperature, (direct measurement and/or calculated value) individual 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. BSM data shall be available in J1939 format.

Bus. The term bus, buses and vehicle are used interchangeably.

Capacity (fuel and DEF container). The volume of a container in useable gallons (liters).
Cells. Individual components i.e. battery or capacitor cells.

Class of Failures. Classes of failures are described below. The following shall be the design objectives for maximum frequency of in-service failures of the types defined, provided that preventive maintenance procedures specified by the Contractor are followed within the limits of practicability dictated by transit maintenance practice.

Class I: Physical Safety - A failure which leads directly to passenger or operator injury or represents a severe potential crash situation, an example of which is the loss of vehicle brakes. Mean distance between failures shall be greater than 1,000,000 miles, or the actual life of the bus.

Class II: Road Call - A failure which results in the interruption of revenue service. An example of this is a vehicle breaking down during service. Mean distance between failure shall be greater than 20,000 miles. Failure of SEPTA installed equipment shall not constitute a Class II failure for the purpose of this section of the vehicles specifications.

Class III: Bus Change - A failure which requires removal of the bus from service during its assignment but does not cause an interruption in revenue service. Mean distance between failures shall be greater than 16,000 miles.

Class IV: Bad Order - A failure which does not require removal of the bus from service during the assignment, but degrades the operation or use of the bus, causing the failure to be reported by the operator. Mean distance between failures shall be greater than 10,000 miles.


Clamps. Clamps are devices arranged to control the fixing of position for cabling, pipes and miscellaneous system elements. Clamps shall be properly applied with the correct closure interference ID for the part involved meaning no measurable movement between the fixture and its attendant fixed device. All clamps shall require and are subject to Pilot Vehicle inspection and therefore SEPTA may direct the Contractor to modify by type and arrangement to specific areas and means if not deemed to be acceptable by SEPTA. Where split-block, splitblock clamps are specified they are to be the best commercially available in the trade and shall where applied be non conductive and ensure by proper application a no chafe fixing. Plastic saddle blocks using tyrap hold downs are specifically prohibited without prior consent by SEPTA on an application basis. All vinyl dipped or rubber extruded shall be over stainless steel and of the highest quality available for its type. Clamps shall not contain or incorporate wood or treated wood. Composite materials maybe used as specifically approved by SEPTA per application basis.

Converter DC/DC. A device used to convert direct current VI to differing levels for specific circuit requirements.

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

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

Defect. Potent or latent malfunction or failure in manufacture or design of any component or subsystem that causes a vehicle to cease operating or causes it to operate in a degraded mode.
Design Operating Profile. The operating profile for design purposes shall consist of simulated transit type service. The duty cycle is described in the figure below.

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<th>Accel Time (S)</th>
<th>Cruise Dist (FT)</th>
<th>Cruise Time (S)</th>
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<th>Decel Dist (FT)</th>
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</table>

“Transit Bus Duty Cycle.” The duty cycle consists of three phases, a CBD phase of two (2) miles with seven (7) stops per mile and a top speed of 20 mph, an arterial route phase of 2 miles with 2 stops per mile and a top speed of 40 mph, and a commuter phase of 4 miles with 1 stop and a maximum speed of 55 mph and a 5 minute idle phase.
The bus shall be loaded to SLW and shall average approximately 18 mph while operating on this duty cycle. Operation shall continue regardless of the ambient temperature or weather conditions. The passenger doors shall be opened and closed at each stop, and the bus shall be knelt at each stop during the CBD phase. The braking profile shall be:

- 16 percent of the stops at 3 ft/sec/sec
- 50 percent of the stops at 6 ft/sec/sec
- 26 percent of the stops at 9 ft/sec/sec
- 8 percent of the stops at 12 ft/sec/sec

These percentages of stops shall be evenly distributed over the three phases of the duty cycle. For scheduling purposes, the average deceleration rate is assumed.

A High Density Urban (HDU) Operating Profile is applicable to certain Septa service. In addition to the above requirements, this profile shall be taken into account during the design of subsystems such as charging, air, brakes, door systems and radiator/coolers. The HDU profile consists of mostly CBD type operating with some arterial and minimal commuter. However, number of stops per mile and loading conditions may be greater than those specified for the CBD cycle. The HDU profile is characterized by the following:
Average Speed 9 to 10 mph
Average Idle Time 50%
Percent Time at 0 to 19 mph 80% range
Percent Time at 20 mph & above 20%

Average speed is defined as the average engine hours versus miles traveled. Much of the “idle” time is due to stop and go nature of the service of the HDU operation. The majority of this idle time is while the bus is in gear and stopped in traffic, or at bus stops, as well as frequent brake applications per mile due to traffic congestion and traffic signals.

**Destroyed.** Physically made permanently unusable.

**Discrete Signals.** A signal which can take only pre-defined values, usually of a binary 0 or 1 nature where 0 is battery ground potential and 1 is a defined battery positive potential.

**Door.** A door as refers to passenger, equipment, or any other device complete with all necessary hardware that affects a door and therefore arranges a door as a functional element—that SEPTA has or may define herein or hereafter, up and until the conclusion of the Pilot phase of fleet acquisition(s) and doors shall be equipped and arranged as SEPTA defines to the contractor herein and hereafter. If, where and when SEPTA designates any space on any basic non-structural area to a vehicle or bus SEPTA specifies, arranges, defines or contemporaneously designates, during and at any part of the contract to which this specification applies, then, it shall be the contractor’s responsibility to provide as many doors as required by SEPTA in the way, manner and means that SEPTA specifies. Upon notification of requirement to furnish said door or doors and where said doors are not otherwise defined by this specification. Door hinge systems and locks shall be defined under the definition and requirements as specified herein. All door systems shall incorporate stainless steel full length piano type hinges and 5/16” fully recessed square cam-ed or friction locks.

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

**Energy Storage System.** A component or system of components that stores energy and for which its supply of energy is re-coverable by an engine driven generator or kinetic energy recovery sources, an off-vehicle electric energy source, or both. This system may consist of electro-chemical, electro-static or a combination of these energy storage means.

**Engine.** Mechanical prime mover device which converts thermal energy into mechanical energy utilized for propulsion and accessory power.

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

**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.

**Fleet Defect.** A conditionally qualified defect defined by this specification, wherein a unit, module or component thereof affects proper or expected operation of said unit sufficiently to cause the affected unit operation to degrade
to a point at which revenue service of the affected vehicle cannot be obtained and said condition(ed) operation affects the qualifying, quantified vehicle fleet.

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

**Fuel Management System.** Diesel 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, pumps, fuel metering equipment (e.g. injectors), sensors (e.g. main throttle, wastegate, fuel pressure).

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

**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.** One hundred fifty pounds for every designed passenger seating position, for the operator, and for each 1.5 square feet 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.

**Heavy Heavy-Duty Diesel Engine (HHDD).** Heavy heavy-duty diesel engines have sleeved cylinder liners, are designed for multiple rebuilds, and a rated horsepower that generally exceeds 250.

**HIC (Head Injury Criteria).** The following equation presents the definition of head injury criteria.

\[
\left[ \frac{1}{t_1 - t_2} \int_{t_1}^{t_2} (a) dt \right]^{2.5} (t_2 - t_1)
\]

Where:

- \(a\) = the resultant acceleration at the center of gravity of the head form expressed as a multiple of \(g\), the acceleration of gravity.
- \(t_1\) and \(t_2\) = any two points in time during the impact.

**High Voltage/Medium Voltage.** (Defined by customary LVDC conditions) Greater than 30 volts (AC and DC) and as defined by ANSI 229.1 and other applicable EN standards. All affected cabling shall be conspicuously identified by application of Orange Loom for propulsion with permanent tag markers indicating circuit number(s) and routing. Auxiliary cabling shall be use Green loom and identified by circuit number.
**Human Dimensions.** The human dimensions used in Section 6: Technical Specifications are defined in SAE Recommended Practice JB33.

**HVAC Ducting.** A channel or tube for conveying conditioned air that conducts from a source to delivery ensuring minimum change in temperature and flow. Air flow efficiency requires ducting as installed and arranged to buses defined by this specification to be complete and fully confined structures. Ducting shall be arranged for the movement of air separate and apart from other utility spaces. Ducting shall of a proper size as to minimize pressure losses while ensuring best laminar flow practice. Objects, devices or structure shall reside outside and not shared in the interior space of HVAC ducting as defined herein. The interior ducting space shall be fully and exclusively arranged for the flow of conditioned air. Ducting assemblies may be a combination of ridged metal or plastic shape, smooth bore tubing or fabric close-out where said close out shall isolate air flow from other utility spaces.

**Hybrid System Controller (HSC).** The electronic controller which interfaces with vehicle and operator I/O and regulates energy flow throughout hybrid system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (e.g.: voltages, currents, temperatures, etc.) within specified operating ranges.

**Hybrid-Electric Drive (HED) System.** The mechanical and electromechanical components, including the engine driven generator, traction motor-series system, combination unit-parallel system and controller(s) which comprise the traction drive portion of the hybrid propulsion system.

**Inverter.** An electrical converter that converts direct current into alternating current.

**Jerk.** The rate of change of acceleration measured at the centerline, floor level of the bus.

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

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

**Low Floor Bus.** A bus which, between at least the front (entrance) and rear (exit) doors, has a floor sufficiently low and level so as to remove the need for steps in the aisle between the doors and in the vicinity of these doors.

**Low Voltage.** 30 volts or less as defined by ANSI 229.1.

**Low Voltage Direct Current System.** A system of batteries and chassis based power sources providing energy for supervisory and control circuits, low voltage consumer loads and other systems that are arranged to operate on 12 and 24 volt direct current nominal voltage.

**Maintenance Personnel Skill Levels.** Defined below are maintenance personnel skill levels used in Section 6: Technical Specifications.

- a. **5M:** Specialist Mechanic or Class A Mechanic Leader (SEPTA 1st Class)
- b. **4M:** Journeyman or Class A Mechanic (SEPTA 2nd Class)
- c. **3M:** Service Mechanic or Class B Servicer (SEPTA 3rd Class)
d. 2M: Mechanic Helper or Bus Servicer (SEPTA General Helper)
e. 1M: Cleaner, Fueler, Oiler, Hostler, or Shifter (SEPTA Fueler/Cleaner)

In Attachment to Section 6: Technical Specifications, SEPTA may relate the skill levels and ratings of mechanics in its operation to the above definitions.

Note: Whenever a specific time is indicated to access components or complete a task, it is assumed the vehicle is in the location where the work is to be performed. All necessary equipment is in its correct position (tools, jacks, vehicle lifts, lighting, fluid recovery systems, etc.) and ready for use.

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

**Module.** A set of standardized parts or independent units that can be used to construct a more complex structure or system.

**Motor (Auxiliary).** Device that converts electrical energy into mechanical energy that is not used for traction purposes.

**Motor (Traction).** Device that converts electrical energy into mechanical energy to accelerate or retard vehicle motion.

**Non-Structural.** For the purpose of this specification, are the physical elements of structure that upon modification of same will not cause, degrade or significantly impact the basic structural integrity of the vehicle in a way or manner as to limit or degrade its useful and expected service life. If a bidder or contractor deems a modification to be at opposition to the Non-Structural definition said bidder or contractor shall furnish a full FMEA report sourced from a 3rd party including full derivate and grading.

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

**Pilot Inspection Program** Technical and contractual elements attending the pilot phase or part of, the specification and contractor's vehicle construction program, whereby certain requirements, documents, qualifying tests and qualifying SEPTA conducted inspection(s) are performed prior to and before the construction of any vehicle thereafter which would be defined as production vehicles. No production vehicles may proceed the conclusion of the Pilot Program as defined herein and executed by the management at SEPTA.

**Physical Layer.** The first layer of the seven-layer International Standards Organization (ISO) Open systems Interconnect (OSI) reference model. This provides the mechanical, electrical, functional and procedural characteristics required to gain access to the transmission medium (e.g., cable, transceivers) and is responsible for transporting binary information between computerized systems.

**Power/Energy Density.** Energy density is the amount of energy stored in a given system or region of space per unit volume or mass. The power of a battery cell in terms of its ability to discharge and accept energy at a given rate.

**Production Vehicles (Buses)** Production buses are those obtained after the conclusion of the Pilot Program phase of a contract governed by this specification. Production buses are those post pilot program buses that are produced
and fully assembled as to be purchased as service ready from the means, facilities and production programs
attending the Contractors specified and proffered production plans. Production buses shall be from plans defining
production means, facilities and production programs as defined, offered and tendered at the bid unless specifically
modified or altered by the specific terms and conditions governing the Contract thereafter as approved by SEPTA.

**Propulsion System.** System that provides propulsion for the vehicle proportional to operator commands. Includes,
as applicable, the HED system, Energy Storage System, and the Hybrid System Controller.

**Regenerative Braking.** Deceleration of the bus by electrically switching motors to act as generators which return
vehicle kinetic energy to the Energy Storage and vehicle Systems.

**Related Defect.** Damage or reduced serviceability for use inflicted on any component or subsystem as a direct
result of a defect.

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

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

**Serial Data Signals:** Serial data signals are a current loop based representation of ASCII or Alphanumeric data
used for transferring information between devices by transmitting a sequence of individual bits in a prearranged
order of significance. Note: An example is the communication that takes place between two or more electronic
components with the ability to process and store information.

**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.

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

**Standard.** Standards referenced in Section 6: Technical Specifications are the latest revisions unless otherwise
stated.

**State of Charge (SOC).** Quantity of electric energy remaining in the battery relative to the maximum rated Amp
hour (Ah) capacity of the battery expressed in percent. This is a dynamic measurement used for the energy storage
system. A full SOC indicates that the energy storage system cannot accept further charging from converters, like
equipment or the regenerative braking system.

**Structure.** The structure shall be defined as the basic body, including floor deck material and installation, load
bearing external panels, structural components, axle mounting provisions and suspension beams and attachment
points.

**Subsystem.** Major component of the vehicle. (i.e. engine, energy storage, hybrid system controller, HVAC,
generator, accessories, propulsion drive, etc.).

**Ultra Low Sulfur Diesel Fuel.** A #2 density distillate fuel containing no more than 15 ppm sulfur that has been
properly additized for all other salient properties.
Wheelchair. A mobility aid belonging to any class of three or four-wheeled devices, usable indoors, designed for and used by individuals with mobility impairments, whether operated manually or powered. A “common wheelchair” is such a device that does not exceed 30 inches in width and 48 inches in length measured two inches above the ground, and does not weigh more than 600 pounds when occupied.

TS 2.1 Abbreviations

The following is a list of abbreviations used in Section 6: Technical Specifications.

ABS  Anti-lock Braking System
ADA  Americans with Disabilities Act
ANSI  American National Standards Institute
ASHRAE  American Society of Heating, Refrigerating and Air Conditioning Engineers
ASAS  Automatic Stop Announcement System
ASTM  American Society for Testing and Materials
AVL  Automatic Vehicle Locating
AVM  Automatic Vehicle Monitoring
BHP  Brake Horsepower
BMCS  Bureau of Motor Carrier Safety
BMS  Battery Management System
BMVSS  Bureau of Motor Vehicle Safety Standards
BTU  British Thermal Unit
CFR  Code of Federal Regulations
CVT  Continuously Variable Transmission
DOE  U.S. Department of Energy
DOT  U.S. Department of Transportation
DR  Diagnostic Reader
ECM  Engine Control Module
EMI/EMC  Electromagnetic Interference/Conducted
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>FMEA</td>
<td>Failure modes and effects analysis</td>
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<td>FMCSR</td>
<td>Federal Motor Carrier Safety Regulations</td>
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<td>FMVSS</td>
<td>Federal Motor Vehicle Safety Standards</td>
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<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
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<tr>
<td>GPS</td>
<td>Global Positioning Satellite</td>
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<tr>
<td>GVW</td>
<td>Gross Vehicle Weight</td>
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<tr>
<td>GVWR</td>
<td>Gross Vehicle Weight Rating</td>
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<tr>
<td>HED</td>
<td>Hybrid Electric Drive</td>
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<tr>
<td>HSC</td>
<td>Hybrid System Controller</td>
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<tr>
<td>HP</td>
<td>Horsepower</td>
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<tr>
<td>HVIL</td>
<td>High Voltage Interlock Loop</td>
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<td>IAS</td>
<td>International Approval Services</td>
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<tr>
<td>ICE</td>
<td>Internal Combustion Engine</td>
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<tr>
<td>I/O</td>
<td>Input/Output</td>
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<tr>
<td>ISO</td>
<td>International Standards Organization</td>
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<tr>
<td>IVS</td>
<td>Intelligent Vehicle System(s)</td>
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<td>JIC</td>
<td>Joint Industrial Council</td>
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<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
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<tr>
<td>LVDC</td>
<td>Low Voltage Direct Current System</td>
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<tr>
<td>MDBF</td>
<td>Mean Distance Between Failure</td>
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<tr>
<td>MDBSF</td>
<td>Mean Distance Between Service Failure</td>
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<tr>
<td>MPH</td>
<td>Miles Per Hour</td>
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<tr>
<td>MUX</td>
<td>Abbreviation for Vehicle Multiplex System</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td><strong>NEMA</strong></td>
<td>National Electric Manufacturers Association</td>
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<td><strong>NFPA</strong></td>
<td>National Fire Protection Association</td>
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<tr>
<td><strong>NHTSA</strong></td>
<td>National Highway Traffic Safety Administration</td>
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<tr>
<td><strong>OEM</strong></td>
<td>Original Equipment Manufacturer</td>
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<tr>
<td><strong>OSHA</strong></td>
<td>Occupational Safety and Health Administration</td>
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<tr>
<td><strong>PD</strong></td>
<td>Potential Difference</td>
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<tr>
<td><strong>PID</strong></td>
<td>Proportion Integral Differential</td>
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<tr>
<td><strong>POST</strong></td>
<td>Power On Self Test</td>
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<tr>
<td><strong>RFI</strong></td>
<td>Radio Frequency Interference</td>
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<tr>
<td><strong>RTC</strong></td>
<td>Real Time Clock</td>
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<tr>
<td><strong>SAE</strong></td>
<td>Society of Automotive Engineers</td>
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<tr>
<td><strong>SCADA</strong></td>
<td>Supervisory Control and Data Acquisition</td>
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<tr>
<td><strong>SEPTA/Septa</strong></td>
<td>Southeastern Pennsylvania Transportation Authority</td>
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<tr>
<td><strong>SLW</strong></td>
<td>Seated Load Weight</td>
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<td><strong>SOC</strong></td>
<td>State of Charge</td>
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<tr>
<td><strong>SPI</strong></td>
<td>Society of the Plastics Industry</td>
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<tr>
<td><strong>UL</strong></td>
<td>Underwriters Laboratories</td>
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<tr>
<td><strong>ULSD</strong></td>
<td>Ultra Low Sulfur Diesel Fuel</td>
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<tr>
<td><strong>UPS</strong></td>
<td>Uninterruptable Power Supply</td>
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<tr>
<td><strong>USDHEW</strong></td>
<td>United States Department of Health, Education and Welfare</td>
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<tr>
<td><strong>USDOT</strong></td>
<td>United States Department of Transportation</td>
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TS 3. Referenced Publications
The documents or portions thereof referenced within this specification shall be considered part of the requirements of the specification. The edition indicated for each referenced document is the current edition, as of the date of the SEPTA issuance of this specification.

TS 4. Legal Requirements
The Contractor shall comply with all applicable Federal, state and local regulations. These shall include, but not be limited to, Federal ADA as well as state and local accessibility, safety and security requirements. Local regulations are defined as those below the state level.

The bus shall meet all applicable FMVSS and shall accommodate all applicable FMCSR regulations in effect at the date of manufacture.

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 5. Overall Requirements
The Contractor shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors’ requirements, recommendations and specific requirements in application of endorsement as defined and required by this specification. Components used in the vehicle shall be of heavy-duty design and proven in transit service except where SEPTA shall deem exceptions to be in their sole best interest(s).

Multi-year, multiple yearly delivery Contracts wherein the Contractor changes, modifies, improves, alters, combines or substitutes any material, component or system with or without SEPTA’s permission or advance knowledge thereof, said circumstance shall, at SEPTA’s sole discretion, permit SEPTA to implement a PILOT VEHICLE PROGRAM as defined herein and by addenda. Further, SEPTA may reject any change(s), modification, improvement, alteration, combination thereof or substitution(s) of any material, component or system not approved by SEPTA at the first pilot inspection, or at subsequent Pilot Inspections for technical or contractual cause.

TS 5.1 General
This specification covers climate-controlled, transit-type 40’ nominal low floor diesel electric hybrid buses equipped for use by transit passengers. The buses shall comply with all applicable requirements of the CFR Title 49, Commonwealth of Pennsylvania and FMVSS, NHTSA, ADA and EPA regulations in effect at the time that vehicles are manufactured pursuant to this Contract. The bidder shall submit independent 3rd party certified documents indicating full compliance for all jurisdictions where vehicles defined herein shall operate in any mode. Modes may include, non-revenue service (requires CDL pre-trip inspection) other service area pre-trip inspections and all operating revenue services. A document package shall define a vehicle complete and ready for service. Any cause limiting or preventing vehicle application to service shall permit SEPTA to exercise its Contract specified remedies.
TS 5.2 Weight
Curb weight of the bus shall be minimized to the extent practical without compromising its integrity and durability and shall not exceed 32,500 pounds. A driver of average skill shall be able to control the bus within a ten (10) foot wide lane during acceleration, coasting or braking at all road conditions. All other pertinent operational characteristics shall be similar to those attending an ICE equipped bus. The front door located, accessibility ramp shall not be less than a rise to run ratio of 1 to 6 when deployed on a level surface kneeled.

TS 5.3 Capacity
The vehicle shall be designed to carry the Gross Vehicle Weight as defined in Section TS 2, which shall not exceed the bus GVWR.

TS 5.4 Service Life
The bus shall be designed to operate in transit service for at least 12 years or 500,000 miles In SEPTA service. It shall be capable of operating at least 41,666 miles per year including the twelfth year. The bus shall be designed to provide a minimum service life of twelve (12) years excluding those items normally considered to be "wear and tear" items but including all frames and/or structural support members.

TS 5.5 Maintenance and Inspection
Prime consideration shall be given to the routine problems of maintaining the buses. Septa, at and during Pilot Inspection phase shall inform the Contractor of required changes and/or modification to areas and systems maintainability where in Septa’s sole judgment, maintainability requirements are suspect or otherwise judged and considered to be insufficient. Unless and until Septa indicates a satisfactory disposition to the Contractor of issues raised, at Septa’s sole discretion, no production of buses may proceed and Septa may elect to extend the Pilot Inspection period until Septa indicates satisfaction in either action or adjustment to warranties or other suitable means as designated from Septa’s project management. All bus components and systems, which may require repair or inspection, shall be installed so that a minimum amount of time is consumed in gaining access to them. It shall not be necessary to disassemble portions of the bus structure and/or equipment, such as seats and flooring, in order to gain access to these areas.

Each bus shall be designed to facilitate the disassembly, reassembly, servicing or maintenance thereof by use of tools and items which are normally available as commercially standard items. Requirement of any special tools must have approval of SEPTA and shall be supplied by the Contractor, in sufficient quantities to simultaneously service each of SEPTA's nine operating locations, with the delivery of the first production bus.

The body and structure of all buses shall be designed for ease of maintenance and repair. Individual panels or other equipment which may be damaged in normal service shall be repairable or replaceable. Lower skirt panels, if used, shall be aluminum, stainless steel, thermoplastic or fiberglass. Each panel must be replaceable within one (1) hour by a single mechanic. Ease of repair shall be related to the vulnerability of the item to damage in service.

It shall be the design goal of the Contractor to minimize the labor-hours required to perform the most frequent repairs and service items listed in this Specification. It shall also be a design goal to minimize the frequency of repair, adjustment, lubrication, and/or inspection of normal maintenance items. Beyond design goals are the specified requirements as defined, designated and declared by this specification. Where specified requirements are explicit, they are not to be treated as other than requirements as such, and/or as clarified by SEPTA.
Repair time and skill levels required for various repairs to bus components shall not exceed mean time or skill levels typically required by SEPTA to repair transit buses. (Ref. Section TS 2 and Section TS 11.13).

Scheduled maintenance or inspection tasks as specified by the Contractor shall require a skill level of 3M or less. Scheduled maintenance tasks shall be related and shall be grouped in maximum mileage intervals. Routine scheduled maintenance actions, such as chassis lubrication, filter replacement and adjustments shall not be required at intervals of less than 6,000 miles except for routine daily service performed during the fueling operations. Higher levels of scheduled maintenance tasks shall occur at even multiples of mileage for lower level tasks. All bolts, bars, screws, clamps, nuts, or other fasteners should not require torque or adjustments at intervals of less than 50,000 miles.

Any special tools required to maintain the bus shall be provided in quantities as specified in Attachment to Section 6: Technical Specifications. Additional requirements for Maintenance and Inspection Equipment are also provided in these attachments.

**TS 5.5.1 Test Ports**

Test ports shall be provided for commonly checked functions on the bus such as air intake, exhaust, hydraulic, pneumatic, charge-air and engine cooling systems. Test ports shall be arranged for contractor supplied common dry brake fitting(s). All ports to be identified by type and function as follows:

- a.) Coolant Pressure Port-ground level engine compartment accessible.
- b.) Front and Rear Service Pneumatic, Main and Auxiliary/Suspension tanks Test Ports-located at an interior manifold space at or near pneumatic and electrical switch interface area.
- c.) Exhaust Ports-Required at every differential point in the system identified with permanent metal plate marker.
- d.) Power Steering-Pressure and return side engine compartment area.
- e.) HVAC-ported to interior return plenum. Identified suction and discharge.
- f.) All tires shall be equipped with valve extenders and supports in order to maintain reliable pressure fill.

The Contractor shall provide a manual listing the times required for typical repair and service items on the bus.

**TS 5.6 Propulsion**

The propulsion unit shall drive the rear axle. The bus shall be propelled in a manner that maximizes safety, comfort and economy of operation. The propulsion system shall apply diesel electric hybrid propulsion topologies designed to optimize fuel consumption and emissions per unit load/distance. The Contractor shall provide SEPTA with a propulsion system that supports multiple and customer selectable propulsion management schemes. The propulsion control schemes/modes shall facilitate the application of buses to general operating profiles defined herein. The Proposer(s) shall submit empirical and calculated data (matrix) that informs SEPTA of various battery management vs. fuel management operating scenarios/tradeoffs in terms of BMS life and fuel economy/emissions. The proposer shall provide an estimate that informs SEPTA of the return on investment for the selected hybrid propulsion topology. The estimate shall include a price schedule (and anticipated escalations charts) for all constituent components. Further, the proposer shall inform SEPTA of the commercial models offered by their subsystem supplier(s) along with the suppliers proposed/anticipated business model.

**TS 5.6.1 Low Voltage Direct Current (LVDC) System**
The application of the low voltage battery based systems energy storage shall be the principal responsibility of the Propulsion Supplier. Therefore, application of systems shall have a technical and contractual boundary condition where the type, topology, supervision and application shall be furnish as a unit by the Propulsion supplier and all LVDC loads are merely an attendant terminal condition to said Propulsion supplier based system. The vehicle system supplier (manufacturer) and their subsystem suppliers shall fully communicate at the chassis physical layer as well as communication for data required to affect a fully functional vehicle system.

TS 5.7 Doors
The bus shall have two (2) doorways; one located forward of the front axle, and one located immediately forward of the rear axle.

TS 5.8 Body
The body shall be built with suitable and easily accessible compartments provided for all modules, and sound deadening insulation wherever needed with all operating devices so mounted as to reduce and keep all noise and vibration to an absolute minimum. Noticeable disturbing rattles and vibration shall not occur from components not readily repairable and able to be tightened. The coach body shall not transmit and/or otherwise conduct propulsion system sourced noise including tires noise above 75dBA as measured in any seated position for a 95% male head position.
The vehicle shall not source and/or conduct noticeable oscillatory forces from any function or combined system elements.

TS 5.9 Omissions
No advantage shall be taken by the Contractor in the omission of any part or detail which goes to make the bus complete and ready for service even though such part or detail is not mentioned in this specification. In case of any variance, these specifications shall overrule Contractor's specifications.

TS 5.10 Approved Equals
The bus shall be constructed as defined under these specifications. Where a brand name or manufacturer's make and model are specified, the term "or SEPTA approved equal" if not written is implied at Septa’s sole discretion. Systems and integrations of same are not subject to approved equals provision; SEPTA is the sole arbitrator in conclusion and status of systems: physical, functional and other, and all salient or consequential dispositions concerned, affected and governed by this technical specification and contract.

TS 5.11 Glazing
All glazing used on this vehicle shall utilize dry seals that allow for quick replacement of glazing. The use of wet seals in any glazing location shall not be acceptable.

TS 5.12 Recommended Practices
The systems, components and materials specified herein shall embody recommended practice, actual experience, compatibility of parts, and all be of the latest service tested and proved developments that can be incorporated without delaying delivery of the buses, unless such delay is approved by SEPTA.
TS 5.13 Welds/Welding
All welds shall be performed in accordance with recommended practices of SAE HSJ1196 and AWSD8.8-79. This shall include, but not be limited to, accurate measuring equipment, proper joint fit up, inspection and calibration of welding equipment, frequent inspections by an AWS certified welding inspector, visual reference standards, appropriate weld repair procedures and employee welding certifications. Welds in structural tubing (if used) shall not bridge gaps larger than the wall thickness of the thinner member. Wheel wells shall be welded and sealed to the frame/body structure. All structural welding shall be performed to and by AWS, MSZ or Canadian Welding Bureau certified guidelines and welders.

TS 5.14 Materials
Unless otherwise specifically provided, all equipment, and articles incorporated in the work are to be new and of the best grade for the purpose intended. Body materials shall be selected and the body fabricated to reduce maintenance, extended durability and provide consistency of appearance throughout the life of the bus. The Contractor shall be required to obtain a certification (non stainless application) from the manufacturer of the coatings applied to the steel frame tubes which states that the surface preparation and coating application methods are of the highest quality and will ensure the optimum level of corrosion prevention. This certification shall be signed and notarized by an Executive Officer of the coating manufacturing firm. If the bus body is manufactured outside of United States, protective coating shall be applied to prevent corrosion damage during shipment. Detailing shall be kept simple; add on devices and trim shall be minimized and where necessary, integrated into the basic design. If Body Structure that is 304 stainless steel the OEM can self-certify that interior and/or exterior tube coatings are not used or needed.

TS 5.15 Operator Enclosure and Barrier
An enclosure barrier panel, between the operator, the left front wheel well and or a passenger seat shall be provided. The barrier shall not be a wrap-around type. The aisle side stanchion shall have a handhold provision. The barrier shall eliminate glare and reflections in the windshield directly in front of the barrier from interior lighting during night operation. The enclosed panel shall extend from the floor to the ceiling, or wheel-housing in a low-floor design, and shall fit the bus side windows and wall to prevent passengers from reaching the operator or his/her personal effects. The Contractor shall provide the dimensional drawing detailing of operator’s enclosure space for SEPTA’s approval at the PILOT INSPECTION. This enclosure shall be ergonomically designed to accommodate the operator’s seat, fire extinguisher, lunchbox, pocketbook, etc. The layout, mounting, barrier-material, coat hook, jacket strap used in the operator’s barrier shall be subjected to SEPTA’s approval at the PILOT INSPECTION.

TS 5.16 Workmanship and Practice
A. Bolts or rods passing through wood shall be sealed with zinc chromate, or other approved sealing compounds. Where wood and wood are placed together, both shall be coated with zinc chromate or other approved sealing compounds. Stainless steel fasteners shall be sealed. The use of threaded rods carrying any form of electrical energy through wood, fiberglass other than those designed and specifically manufactured as solid (non-floating) flanged studs are prohibited.

B. All exterior light fixtures shall be fitted to the contour of the bus body and adequately sealed to prevent entrance of moisture and/or dust. All lamps, indicator and visual lighting shall be solid state. Any SS lamp or system shall, where load current exceeds 500ma be arranged utilizing connections that permit 150% ampacity of the devices rated current at said connection and or terminal points. All lamp connector wiring shall permit a minimum eight (8) inch pull out to its’ sealed plug disconnection. All lamps to be of sealed type and impact resistant. All exterior lighting, including headlamps shall be FMVSS 108 rated solid state (LED). Headlamps shall utilize voltage drop resistance (or active stabilizer circuit) to ensure lamp
manufacturer design voltage not exceeded in operation. All interior passenger, engine compartment, equipment locations, instrument panel/driver dashboard and customer information and other displays shall be solid state (LED) lighting.

C. All elastomeric seals on the ventilator doors and compartment cabinet doors shall be laced in "V" shaped channel to firmly hold elastomer in place. Seals are to be permanently cemented to the underside of the doors or to the shoulders of doors. Butyl sealing may be used where approved.

D. All burrs and sharp edges shall be dressed so as to prevent injury to passengers, operators, and maintenance personnel.

E. Welding procedures, welding materials, and qualifications of operators shall be in accordance with the American Welding Society Standards or SEPTA engineering approved equal standards.

F. All welds visible to the public shall be ground smooth after welding to present a smooth workmanship appearance. Where metal is welded to metal, the contact surface shall be free of scale, grease, and paint.

G. All solid state electronic devices shall be so constructed as to eliminate all frequencies that are objectionably audible to either human or canine passengers or bystanders. Said devices shall operate without generating or susceptibility to emitted radiated or conducted noise sufficient cause improper operation to the devices themselves, or other devices where normal passenger and maintainer equipment shall be deployed.

H. Special care shall be taken with the outside sheathing, roof, roof bonnets, and the interior finish so that all kinks and buckles are removed before assembly and that they present a true smooth finish without excessive grinding off of material so as to weaken the structure.

I. All wires, cables, tubing, hoses, etc., must follow generally straight line installation to avoid chatter and must not potentially chafe against adjacent metal or plastic components. Minimum safe tolerance shall be 0.125" unless specifically waived in writing by SEPTA.

J. The workmanship must be the best obtainable in the various trades.

K. All dissimilar metal interfaces shall be electrolytically protected.

L. Shielding in front and on the sides of operator's feet shall be provided to prevent interference with mechanical devices and to prevent accumulation of trash in recesses.

M. The defroster plenum chamber is to be screened to prevent entry of debris at the base of the windshield or from the left side.

N. Electronic devices that are specified for input stabilization shall operate utilizing interposing converters and like equipment designed and applied to provide highly stabilized voltage ± 5% output @ +10 to -40% input, in order to ensure proper operation of propulsion, electrical multiplex and AVL/M equipment.

O. All devices or units receiving, passing through or emitting alternating or direct currents exceeding two hundred miliamperes (200ma) from their terminal or other conductive non specific termination or chassis points in/of contact shall not conduct said currents through structures (conductive, galvanic or capacitive) to
which said units are affixed to. Negative or common return cabling shall be diverted from said mounting fixtures and frames by proper cable shunting to terminating points where current does not flow through fiberglass, plastics and sealants. Devices and units exceeding the limiting current specified herein shall be required to be of proper dedicated cabling shunts arranged to mounting structures as to preclude conducted currents from passing through primary or secondary fixing points or mounting in any circumstance whereby those shunted currents may pass through studs and/or fixing points that physically pass through any non metallic structure or other structure SEPTA deems and or specifies as prohibited.

P. Conventional BCI group 31 Low Voltage batteries shall not be aged greater than 30 days in advance of delivery to SEPTA’s property. Batteries found by inspection at Contractor’s facility found to be exceeded in specified age or unmarked shall be rejected for installation. The Contractor shall provide proof of purchase with traceable date coding indicating compliance with the requirements of this section and whereas else defined by this specification. Batteries or energy storage supplied as an integrated system from the Propulsion system supplier shall meet the basic warranty requirements of traction battery/energy storage systems.

Q. Roof mounted devices, equipment boxes and like equipment shall where wiring enters and exits said boxes or other roof mounted fixtures by design shall preclude accumulated and/or random water, snow and snow pack and sustained inundation and contact with said equipment from causing damage that in any way degrades or effects the service quality of the connections. Di-electric grease of a type insuring plastic state maintainability throughout exposed temperature ranges where shall be applied to all connectors.

R. All removable interior panel fasteners shall be captive Torx™ or Phillips stainless steel SEMS washer type.

S. A qualified smoke test, said test judged to be passed as indicated by SEPTA’s representative signature, shall be performed to all vehicles governed by this specification and contract as a qualifying condition for delivery. A qualified test is where the vehicle is ready for inspection for purchase at the Contractor’s plant or facility. The test shall be conducted with the vehicle interior under a negative static pressure with respect to the smoke emitting source.

T. All CAN, J1939 and proprietary vehicle system networks shall have no tapping or splicing points below the exposed underside floor of the vehicle. All network taps/splices and drops shall be compliant to their particular physical layer standards and where those standards cannot be attained, taps, splices shall be installed in IP65 rated junction boxes. And said IP rating shall be maintained by proper application of seals or like means to prevent less than IP65 implementation.

**TS 5.17 Electronic Data Collection**

All specified data collection sources and destinations shall be identified and mapped by the Contractor in order to prove the accuracy and fidelity of all data collected and stored for the purpose of vehicle based messaging and export to third (3rd) party devices. The Contractor shall demonstrate the exportation of data to dedicated SEPTA access devices and servers. The Contractor shall provide all user software required to convert exported data to maintenance reporting data management tools. The Contractor shall supply site licensing with no number of user restrictions for software products, where defined, including Clever Devices BusTime®, AVM®, CleverReports, and Clever Analytics (Idle Monitor™ & Incident Analytics), required to effect complete, operationally functional data collection and management systems wherein all monitored data can be organized as reliable and accurate management tools. The Contractor shall provide a plan that identifies all source signals and said signals shall be generated at the physical layer of the data collection system for the purpose of proving the proper origination, vehicle systems acquisition and storage of; number(s) of data transfers to server(s) and by integration with current
SEPTA network systems affect upon delivery of the first production bus under this Contract, all fully function system. All proposers shall submit a plan that defines the way and manner in which they shall accomplish this specification requirement.

**TS 5.18 Accessibility**
All systems or components serviced as part of periodic maintenance or whose failure may result in Class I or Class II failures shall be readily accessible for service and inspection. To SEPTA’s sole satisfaction, removal or physical movement of components unrelated to the specific maintenance and/or repair tasks involved shall be unnecessary. Relative accessibility of components, measured in time required to gain access, shall be inversely proportional to frequency of maintenance and repair to the components.

**TS 5.19 Interchangeability**
Components with identical functions shall be interchangeable between buses. These components shall include, but not be limited to, front and rear suspension systems, power train components, e.g., engine, propulsion system, HVAC, seat assemblies, passenger/operator window hardware, doors, interior trim, lamps and lamp lenses. Components with non-identical functions shall not be or appear to be, interchangeable. Locations for components, sub-assemblies, hatches, windows and doors shall be identical between buses, unless otherwise approved by SEPTA. Standardization of parts and direct interchangeability shall be maintained throughout the entire production. Any changes that may occur shall require SEPTA approval.

**TS 5.20 Operating Environment**
The bus shall achieve normal operation in temperature ranges of -10 degrees F to 110 degrees F, at relative humidity between 5% and 100%, and at altitudes up to 5,000 feet above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below -10 degrees F, above 110 degrees F, or at altitudes above 5,000 feet.

Special equipment or procedures may be employed to start the bus after 12 hours or more of exposure to temperatures below +30 degrees F without the engine in operation. Speed, gradability, and acceleration performance requirements shall be met at, or corrected to, 85 degrees F, 29.00 inches of Mercury (Hg), dry air. Performance degradation at conditions other than the test standard shall not exceed 1% for each 3 degrees F, or 4% for each 1,000 feet of altitude above the standard. The interior climate control system shall perform in accordance with Section 6 of the Technical Specification.

**TS 5.21 Noise**

**TS 5.21.1 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 less at any point inside the bus. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and accessories switched off. The vehicle structure shall not conduct, amplify and/or radiate noises due to drive line components, electronic and/or electro-mechanically sourced in any mode of operation and/or service that causes and/or exacerbates or aggravates interior or exterior noise levels defined by this specification.

The bus-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 80 dBA and the operator shall not experience a noise level of more than 75 dBA under the following test conditions. The bus
shall be empty except for test personnel, not to exceed 4 persons, and the test equipment. All openings shall be closed and all accessories shall be operating during the test. The bus shall accelerate at full throttle from a standstill to 35 mph on level commercial asphalt or concrete pavement in an area free of large reflecting surfaces within 50 feet of the bus path. During the test, the ambient noise level in the test area shall be at least 10 dBA lower than the bus under test. Instrumentation and other general requirements shall conform to SAE Standard J366. If the noise contains an audible discrete frequency as defined in Section TS 2, a penalty of 5 dBA shall be added to the sound level measured. The Procedure for Measurement of Interior Noise is defined in Attachment TS 11.6.

**TS 5.21.2 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 or below 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dBA. The bus-generated noise at curb idle shall not exceed 65 dBA. If the noise contains an audible discrete frequency as defined in Section TS 2, a penalty of 5 dBA shall be added to the sound level measured. All noise readings shall be taken 50 feet from and perpendicular to, the centerline of the bus with all accessories operating. Instrumentation, test sites, and other general requirements shall be in accordance with SAE Standard J366. The Procedure for Measurement of Exterior Noise is defined in Attachment TS 11.7.

In addition, the Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by SEPTA. Reference: Philadelphia Code of Ordinances and Home Rule Charter (Latest Revision) Section 12-1127 Excessive Idling of and Noise from Motor Vehicles.

**TS 5.21.3 Electronic Noise Control**

Electrical and electronic subsystems and components on all buses shall not emit electromagnetic radiation that will interfere with on-board or nearby radio communication or violate regulations of the Federal Communications Commission. On-board equipment can include two-way radios, electronic fare collection equipment, automatic vehicle locating devices, electronic trip recorder and video surveillance camera, etc. The Contractor shall test the Pilot Vehicle Utilizing the Procedures prescribed in CISPR 12/25 or current applicable EN standards. A report of test shall be submitted to SEPTA prior to production of buses and said report results shall be approved by SEPTA-no production buses shall be accepted without said approval.

**TS 5.22 Engine Emission**

All buses shall conform to the air pollution control standards of the Environmental Protection Agency (EPA) of the Federal Government and shall meet air pollution requirements of the State of Pennsylvania and the City of Philadelphia. Engines shall be certified on No. 2 Ultra Low Sulfur diesel fuel. All exhaust emission components shall be arranged to be serviceable and easily removable to the greatest extent practicable.

**TS 5.23 Regulatory/Standards Requirements**

All buses shall comply with Federal Motor Vehicle Safety Standards (FMVSS) as established by the United States Department of Transportation. Compliance with this specification does not relieve the Contractor from complying with all applicable Federal, State, City, other requirements and/or standards (e.g., SAE, ASTM, ANSI etc.) or the manufacture, sale or use of such buses.
The bus shall be designed and manufactured in accordance with all applicable fire safety and smoke emission regulations. These provisions shall include the use of fire-retardant/low-smoke materials, fire detection systems, firewalls, and facilitation of passenger evacuation.

All plastic and synthetic materials used inside the bus shall be fire-resistant, except vinyl seat coverings if used which shall meet the current requirements of Federal Specification CCC-A-80a class 2(a)1 and seating upholstery textiles which shall meet the current requirements for textiles in Federal Aviation Regulations 25.853(b), as tested in accordance with Appendix F of the part. Furthermore, SEPTA requires that seating cushions, frames, shrouds, and upholstery, as well as ceiling and wall panels shall meet the test procedures and performance criteria established for flammability and smoke emission in FMVSS 302.

Fire detection systems as required in Section TS 10.9 shall be provided.

Requirements for firewalls are contained in Section TS 9.1.6.

The requirements for passenger evacuation provisions related to doors, windows, and escape hatches are defined in Section TS 9: Technical Specifications.

The bus electrical system shall be designed so that no casual contact with electrical components, devices or equipment that have sufficient voltage (EMF) to cause bodily injury or startle reaction shall be possible. There shall be no high voltage wiring components or devices accessible to passengers. High voltage cables, wires and harnesses shall be installed in dedicated conduits, troughs or cable ways as to preclude contact with low voltage cabling. High voltage cabling shall be identified in accordance to the SAE J-1673. Low voltage systems shall operate independently of high voltage systems. For maintenance purposes, all device enclosures containing high/medium voltage circuit potentials shall be indelibly and permanently labeled “DANGER HIGH VOLTAGE”. All high voltage cables shall be identified by safety orange conduits and/or sleeves and where and else specified herein. Passengers, operators and other non-trained personnel shall be prohibited from contact with aforementioned high voltage sources.

The energy storage system which may consist of batteries and/or capacitors shall be packaged to permit ease of service, while preventing hazardous concentration leaked/vented liquids, solids or gases and the fugitive release of same to any area other than those designed for containment. All other propulsion system equipment shall be suitably arranged to prevent casual contact with high voltage circuits. All high voltage equipment covers shall be mechanical and/or electrical interlocked as to prevent propulsion system operation or unintended high voltage at open terminals and/or connectors. All high voltage cabling shall be identified, labeled and color coded orange.

It shall not be possible to contact high voltage circuits with access cover closed. Access covers shall require the removal of at least a bolt, screw or latch. Propulsion system circuits may maintain high voltage condition with covers removed for the purposes of test. Energy storage and propulsion devices shall be arranged to withstand all expected shock, torsional and vibratory loads accompanying normal vehicle operation and as specified herein and shall not come in to contact with the bus body and/or other non-equal-potential sources not greater than 30 volts DC. All propulsion containers and housings shall not be physically ejected from the vehicle up to and including severe crash situations.

The propulsion system electrical components shall meet all applicable NEC, (NFPA), UL, SAE and EN standards for equipment of this type. The system supplied shall meet the applicable sections of UL-2202, “On Board Charging of Storage Devices”, UL-2231, 51 and UL-2594--if wayside charging is utilized as an auxiliary test.
Warning signs shall be provided for first responders, fire emergency and rescue crews, maintenance and other like personnel informing them of the specific nature of this equipment in regard to chemical, high voltage or synergies of same. All high voltage sources and ground points shall be properly labeled. Energy storage and propulsion systems shall monitor leakage current or potential difference points and said system shall report irregular operating conditions as specified herein.

**TS 5.25 Elderly and Disabled Passengers**
The Contractor shall comply with all applicable Federal requirements defined in the Americans with Disabilities Act, 49 CFR Part 38, and all state and local regulations regarding mobility-impaired persons. Local regulations are defined as those below the state level.

**TS 5.26 Sustainability and Respect for the Environment**
The Contractor shall ensure that all systems are designed and built to ensure their maximum life and efficiencies are realized. It is SEPTA’s intention to specify and purchase mass transit vehicles from contractor’s sharing a vision for sustainable, efficient and reliable products and manufacturing processes that benefit our customers and future generations while leaving a smaller footprint on the world.

In the design and manufacture of the bus the Contractor shall make every effort to reduce the amount of potentially hazardous waste generated by SEPTA when maintaining the bus in accordance with the procedures contained in the manufacturer’s maintenance manuals. In accordance with Section 6002 of the Resource Conservation and Recovery Act the Contractor shall use, whenever possible, and allowed by the specifications, recycled materials in the manufacture of the bus.

**DIMENSIONS**

**TS 6. Physical Size**

With the exceptions of exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers, and rubrail, the bus shall have the following overall dimensions as shown in the figure “Transit Bus Exterior Dimensions” at static conditions and design height.

**TS 6.1 Body Length**

40 – 42.5 feet max.

**TS 6.2 Body Width**

102 inches (+0, -1 inch)

**TS 6.3 Maximum Overall Height**

133 inches, includes all rigid roof mounted items such as A/C, exhaust, rear destination sign, etc.

**TS 6.4 Step Height**

Step Height shall not exceed 15.5 ± .2 inches measured at the center line of the front door.
**TRANSIT BUS EXTERIOR DIMENSIONS**

**TS 6.5 Underbody Clearance**
The bus shall maintain the minimum clearance dimensions as shown in the figure “Transit Bus Minimum Road Clearance” and defined in SAE Standard J689, regardless of load up to the gross vehicle weight rating.

**TS 6.6 Ramp Clearances**
Approach angle shall be no less than 8.5 degrees. Front breakover angle shall be no less than 10 degrees. Rear breakover angle shall be no less than 8.5 degrees. Departure angle shall be no less than 9 degrees.

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

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

The breakover angle is the angle measured between two lines tangent to the front and rear tire static loaded radius and intersecting at a point on the underside of the vehicle that defines the largest ramp over which the vehicle can roll.
**TS 6.7 Ground Clearance**
Ground clearance shall be no less than 9 inches, except within the axle zone and wheel area. The axle zone clearance, which is the projected area between tires and wheels on the same axial centerline, shall be no less than 5½ inches. The wheel area clearance, shall be no less than 8 inches for parts fixed to the bus body and 5.6- inches for parts that move vertically with the axles.

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**TS 6.8 Floor Height**
Height of the floor above the street shall be no more than 15.5 + 0.2 inches measured at the centerline of the front and rear doorway. The floor may be inclined along the longitudinal axis of the bus, and the incline shall be less than 2° off the horizontal except locally at the doors where 2° slope toward the door is allowed. All floor measurements shall be with the bus at the design running height and on a level surface and with the standard 305 tires.

**TS 6.9 Interior Headroom**
Headroom above the aisle and at the centerline of the aisle seats shall be no less than 78 inches in the forward half of the bus tapering to no less than 74 inches forward of the rear settee. At the centerline of the window seats, headroom shall be no lower than 62 inches. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his/her head, padding shall be provided on the overhead paneling.

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**VEHICLE PERFORMANCE**
TS 7. Propulsion System

TS 7.1 Performance

TS 7.1.1 Power Requirements
The propulsion system shall provide adequate horsepower and torque to enable the bus to meet the minimum acceleration, top speed, and gradability requirements given in this Specification. These requirements shall be met with all accessories at their maximum capacity. The Contractor shall consider these requirements as the minimum and the Contractor shall submit detailed performance curves for the bus for approval by SEPTA. The propulsion system shall have a design life of at least 12 years or 500,000 miles.

TS 7.1.2 Top Speed
The bus shall be limited to a top speed of 62 mph on a straight level road at GVWR with all accessories operating to maximum capacity.

TS 7.1.3 Gradability
All buses shall be capable of operation up and down grades of 8 percent and less, up to one mile in length, with full test load (Ref. Section TS 7.1.4), making intermediate stops without overload or damage at a sustained speed of 10 miles per hour, on a dry pavement, with all accessories operating. The gradability requirements shall be demonstrated on a production SEPTA bus, if so required by SEPTA.

TS 7.1.4 Performance and Acceleration
The acceleration shall meet the requirements below and shall be sufficiently gradual and smooth to prevent throwing standing passengers off-balance. Acceleration measurement shall commence when the accelerator is depressed – (Idle Start.)

MAXIMUM IDLE START ACCELERATION TIMES ON A LEVEL SURFACE

<table>
<thead>
<tr>
<th>SPEED (MPH)</th>
<th>TIME (SEC)</th>
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<tbody>
<tr>
<td>10</td>
<td>4.0</td>
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<tr>
<td>20</td>
<td>9.75</td>
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<tr>
<td>30</td>
<td>18.0</td>
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<td>40</td>
<td>30.0</td>
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<td>50</td>
<td>45.0</td>
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</table>

The rate of change of acceleration shall be minimized throughout the acceleration/ deceleration range and shall be no greater than 0.3g/Sec. This requirement shall be achieved regardless of operator action. An operating test for these requirements shall be carried out on a production SEPTA bus, if so requested by SEPTA.
TS 7.1.5 Operating Range
The operating range of the coach run shall be 350 miles when run on the Transit Coach Duty of Design Profile Cycle loaded to SLW, Ref. SAE J1376, Fuel Economy Measurement Test (Engineering Type) for Trucks and Buses. Ref. TS 2 Definitions, Transit Bus Duty Cycle.

TS 7.1.6 Fuel Economy and Supplemental Additive (DEF) Requirements
The engine/propulsion system shall be tuned when delivered to provide optimized performance as specified above and as specified throughout this document. All related components and configuration that affect fuel economy, propulsion system output/recovery and associated control algorithms, battery pack energy management and associated control algorithms, fan control/operation, axle ratio, etc., shall be selected accordingly. The bus shall meet a design goal of an average fuel economy of 20% greater than an equivalent ICE bus when run on the Transit Coach Duty of Design Profile Cycle loaded to SLW. Reference SAE J1376, Fuel Economy Measurement Test (Engineering Type) for Trucks and Buses. Reference TS 2 Definitions, Transit Bus Duty Cycle Definition.

TS 7.2 Propulsion System Description

TS 7.2.1 Propulsion System Service
The propulsion system shall be arranged so that all units and associated modules can be removed and installed with no special tools other than those attending lifting and ground supported equipment. The removal and re-installation of prime mover, traction generator, hybrid drive unit, traction motor, associated controllers and main power cabling shall not exceed eight (8) man/hours. Higher frequency attention units shall require proportionally less time generally and where specified by table §TS 11.13. All propulsion unit modules shall be logically arranged for the facilitation of maintenance. All propulsion system data ports shall be located in areas where best used in conjunction with other necessary tools, best ergonomic practice and at or near system controllers. All modules shall be arranged with permanently affixed connector caps that shall protect unit connector from damage during transport. All module wiring shall be arranged so that no fold backs of said harness exist other that a length required to meet the re-terminating requirements of this specification. All propulsion systems interface wiring shall terminate or interface to flanged metal housings where such housings support the connections, plugs in rank fashion, inclined with proper drip loop cable deployment using flanged receptacles with fully engineered gasketing. All cabling shall be indelibly and conspicuously labeled for identification including drawing plate references.

Rear start and run switches shall be provided. The switches shall function regardless of master switch and anti-theft switch position.

Front and Rear Run Switches shall effectively operate as asynchronous and redundant mode controllers. Where subordinating or sequenced functionality is required, it shall be specified herein. Where it is not explicitly required it shall not be arranged or installed.

The rear run switch shall “wake-up” the multiplex system if timed out. The switches shall be located in the engine compartment in close proximity to the gauge cluster. The switches shall be booted and protected from grease, oil and water intrusion. A manual throttle control shall be installed in the same area. The throttle control shall function when the rear run switch is “on” and the engine is running and shall be inoperative for all other operating modes.

The propulsion control system shall be arranged with a voltage regulator system that ensures constant voltage stabilization of propulsion systems controllers by interposition of step down regulation from the 24 volt to 12 volts.
TS 7.3 Engine Driven Generator/Parallel Drive Unit and Traction Motor
A 3M-5M mechanic, with optional assistance, shall be able to remove and replace the traction motor/parallel drive unit assembly for service in less than 8 total combined man-hours. The propulsion system shall be designed to operate for not less than 500,000 miles on the design operating profile without replacement or major service.

TS 7.3.1 Generator
The traction generator (series system) shall be the brushless type designed and properly applied for automotive service. The traction generator shall have a high output to weight ratio and shall by virtue of design and application not exceed rated temperature in any mode of operation. The traction generator rotor, field and stator shall be sufficiently well matched and arranged so that all output range can be obtained while vibration and noise are minimized. The generator shall be arranged so that it can motor the prime mover. The traction generator shall not require servicing of the unit and/or associated support equipment other than filter(s) that support liquid cooling—if so equipped. The traction generator shall be able to be removed without the removal of the prime mover. The traction generator high voltage output and control wiring shall be suitably interlocked as to prevent unintended operation of equipment. All high voltage circuits shall be looped in order to prevent unintended voltages from appearing at exposed terminations. The traction generator shall support full separate and integrated diagnostic regimes designed to minimize out of service circumstances. If the generator is the air cooled type, suitable ducting and/or inertial traps shall be arranged in order to maintain necessary unit cleanliness. The traction generator bearing shall not require remedial servicing and shall operate as intended until unit rebuild. The traction generator shall utilize dedicated high voltage terminal box(es) that are easily accessible to maintenance personnel. All other ancillary wiring shall meet or exceed specification as defined this document, additionally-all traction generator control wiring shall be mechanically keyed as to prevent improper make up of equipment.

TS 7.3.2 Hybrid Drive Unit – CVT or Clutched Gearings
The hybrid drive unit (parallel type system) shall be designed to meet all applicable requirements attending §TS 7.3.1 and §TS 7.3.3.

TS 7.3.3 Traction Motor
The traction motor(s) shall provide the necessary vehicle propulsion and brake energy recuperation and shall by design, construction and proper application afford the highest efficiencies possible for all modes of operation. The traction motor shall not require remedial service at interval greater than rebuild/overhaul. The traction motor shall be easily removable from beneath the vehicle and its removal shall not require any proprietary tools or fixtures. Terminal box(es) and lugging shall meet requirements as described by §TS 7.3.1, and cabling development shall be arranged to preclude vibratory fatigue, chafing, environmental and other forms of degradation. The traction motor shall be able to operate at 100% duty cycle for 20 hours of CBD operation per day without a temperature rise exceeding its rated capacity @ a cooling efficiency of 50% of rated capacity. The motor primary shall be insulated to Class H standards using the latest materials and application techniques. The traction motor electrical connectors shall be arranged so that improper make up at termination point is mechanically prohibited. All auxiliary sensor(s), thermistors and like equipment shall be self-gapping and/or arranged in wells that require no special setting tools. Sensor wiring shall be arranged so that mis-termination cannot occur. All termination shall be of the highest quality available in the trade and said equipment shall not degrade from environmental effects and/or effects related to application and location.
TS 7.3.3.1 Traction Motor Mounting
The traction motor shall be arranged so that special alignment tools and/or techniques are not required to properly replace and align the motor. The traction motor shall be mechanically arranged so that single point mechanical fastener failures cannot cause failure to the mounting of the motor. The second order isolation fasteners (mounts and drive shaft) shall be arranged so that they are either interchangeable or otherwise constructed to preclude mis-assembly to critical parts. All parts of this system shall be completely interchangeable between vehicles.

TS 7.3.3.2 Hybrid System Cabling and Conduits
All exposed wiring, connector(s) and other necessary hardware affecting a wiring means or system shall be UV and bus washer soap tolerant and shall not degrade in service as defined by service life definitions herein and to the 12th year of operation minimum.

a) High Voltage termination
All high voltage cabling shall be designed and applied to preclude crimp, fastener or other related failures causing excessive IR (current * resistance) drop and any other physical, electrolytic and/or mechanical condition that derates, or causes collateral system damage. Motor terminal boxes shall be arranged in and about structure and other appliances as to permit lateral access to terminal cover screws terminals at a minimum of 100mm clearance. Where high voltage taps are required, they shall be arranged in safety interlocked dedicated junction boxes.

b) High Voltage Cables
All high voltage cables shall reside in conduits and/or cable ways with suitable anti-chafe measures, including necessary bushings, split block clamps, anti-shorts (conduit bushings) and all other devices and appliances constituting NEMA standard methodologies. Cable ways shall not accumulate, condense and/or otherwise collect moisture sufficient to cause cable system degradation.

c) Low Voltage and Data Cables
All low voltage/data cables shall progress and deploy from controllers and/or drive units, energy storage systems, propulsion and auxiliary inverters or convertors, vehicle interface system demarcation point(s), by means of separate and dedicated wire ways where said wire ways shall not be bundled and/or physically connected to other vehicle wiring, pneumatic and/or hydraulic systems. Within this specified system, data, signal analog, discreet switched, and actuator related wiring shall be segregated, indelibly and conspicuously identified.

All wiring shall be arranged to facilitate component substitution for the purposes of system emulation and/or circuit continuity test. All exposed wiring shall be arranged with connectors that preclude water and/or other derogatory pollution and cables shall be physically inclined and arranged by proper looping to preclude water intrusion through couplers and back-shells. Network CAN wiring shall upon roof structure exit be arranged so that round wire jacketed cabling shall progress through suitable seal tight connects so that no flange mounted connectors are permitted. All connectors where permitted by SEPTA shall be arranged to the highest possible mounting area so that connections shall be arranged at the highest elevation from said roof line exterior.

TS 7.4 Energy Storage System and Controller – ESS
For series or parallel drive application the drive system sub-supplier shall furnish the ESS. The battery pack(s) shall be designed to perform by application and capacity that promote an efficient and effective cycling vs. capacity strategy. Both series and parallel drive topologies shall equally conserve fuel and by application and control designed and implemented to utilize battery services in order to achieve said requirement. The batteries shall be arranged in a modular and physically logical way that facilitates proper performance, inspection, maintenance and replacement. The battery pack system (all topologies and drive systems) shall operate without replacement for a period of no less than ninety six months (96), 8 years at the most demanding transit operating profile. The bidder shall plainly and clearly define and state the operating profile limiting ampere hour throughput rate for the ESS as applied to the transit bus system as specified holistically herein, for those statements shall include the...
general, most restrictive and least restrictive limiting case by operating profile, auxiliary features and applications. The bidder shall define the statistical variations to ESS life and the estimated fuel and green-house gas mitigation resulting from their systems and applications.

**TS 7.4.1 Battery Pack Mechanical Arrangement**

The battery(s), packs and local wiring shall be inspectable without the necessity of hand checking internal or external pack connections. The modules/frames and/or support structure shall be removable with Contractor supplied lifting fixture. Any/all (as required) traction battery inlet or other filtration means shall be easily accessible and shall not require the removal of other devices for scheduled maintenance and said activities shall not require the removal and/or displacement of other equipment.

Where traction batteries are refrigerant based forced cooled, the system shall be part of the basic HVAC cooling system—where a remote evaporator supplies heat exchange and the compression, condensing and necessary processing are furnished from the main HVAC unit.

Local liquid line valve(s), line sets, filtration and other attending equipment shall be arranged for unfettered access for inspection and maintenance.

The overstructure/shrouding, door(s) shall not interfere with the removal of the ESS/battery. The doors shall be suitably retained in order to prevent unintended loss of the structure fasteners, hinges and other constituent parts. The doors shall incorporate lift assist and retaining struts, exterior walkway antiskid material.

The Contractor shall supply twelve (12) lifting adaptors to facilitate the removal of whole or partial ESS module components.

The propulsion system shall be interlocked so that battery maintenance prohibits propulsion make up except when specifically permitted by the following conditions:

i). Maintenance door/panel closed-proximity switch only

ii) Propulsion system software enables operation without battery pack

**TS 7.4.2 Battery Pack Monitoring and Supervision**

The battery pack(s) shall be monitored for the following parameters through end user level software:

i). Battery string voltage/SOC-per pack

ii). Battery internal temperature-per pack

iii). Pack status-available energy-total

iv). Estimated cycle life/amp hours total

v). Alarm to maximum discharge/warm-warm to shut down-shut down

vi). Over temperature warn/shutdown

vii). Fire/suppression activated/shut down propulsion 15 seconds after suppression activation

viii). Maintenance required-specify cause J1939 format

ix). Cable/terminal high resistance

x). Card or module status

xi). All auxiliary devices, filtering, stabilization capacitance, contactor(s), isolation faults, internal system controllers, fan management, inlet air filtration monitor (or equal) faults and operating conditions.

xii). Traction battery loan out (energy transfer) in watt hours total, min/max to resident control application. Diagnostic environment and 3rd party reporting devices.
TS 7.4.3 Battery Pack Connections
The battery pack high voltage bus connecters shall be equipped with redundant fastener hardware and/or tension washers or other equal means of maintaining proper torque and termination properties.

TS 7.4.3.1 High Voltage DC Junction Box
A high voltage terminal box shall be arranged and supplied regardless of system topography or series or parallel type system provided. The terminal box shall facilitate the connection of currently arranged devices and appliances requiring direct access to the traction battery mains. The junction box shall monitor VI through its source and destination points. It shall incorporate a spare channel for future device interconnection. The junction box shall be fully isolated from LVDC controls and controllers as well as interlocked. The housing shall be arranged to fully protect and weather proof all internal devices and all external connectors shall ensure the basic integrity of the box is maintained throughout its operating life.
Terminal boxes shall meet the requirements of § TS 7.3.3.2 Hybrid System Cabling and Conduits and roof mounted terminal boxes, junctions and all other cable ways shall provide 200mm of clearance of approach for inspection and repair of cables and terminals without the removal of other appliances and fixtures.

TS 7.5 Hybrid System Controller

TS 7.5.1 System Function(s)
The propulsion system shall have an auto neutral feature that shall cause it to automatically and immediately shift to “Neutral” whenever the propulsion system is selected in range and the parking brake is applied or the antitheft switch key is switched to OFF. This system shall also automatically shift the propulsion system to “Neutral,” after a 5-minute delay, whenever the exit door brake interlock is applied.

An automatic multi-stage auto apply recuperation shall be provided-optimized electric braking energy recovery. Initial excitation shall commence at lift pedal operation of the throttle. The additional excitation shall be obtained upon initial brake pedal actuation less than 4 PSI of the pneumatic brake valve output. A brake pedal application of 6 to 10 psi @ zero velocity set shall be required by the operator to select and obtain forward or reverse range from the neutral position.

The system shall be designed to provide the greatest amount of kinetic energy recuperation per unit velocity mass and as defined by §TS 7.5.5.1 and §TS 7.5.5.2.

The propulsion system shall be equipped with a starter interlock that prevents the starting of the engine unless the propulsion system is in neutral with the parking brake applied. The drive control system shall cease operation (orderly shutdown) after 5 minutes when operating in neutral. The shutdown time feature shall be modified by ancillary vehicle control systems conditions:

TS 7.5.1.1 Ambient Temperature High/Low-Customer Control Setup
Ambient Temperature High/Low-Customer control setup shall enable customer specified exterior temperature overrides for high and low ranges. The climate control system (or discreet device) shall source necessary temperature reading via CAN telegrams to system controller, said data shall be processed for control modification. An enabling switch located in the AVL/M cabinet (labeled “Idle Shutdown Enabled/Cutout) shall upon enable control the following conditions-within set points, shutdown routine shall be modified. Upon low/high temperature
override set, the system controller shall escalate the idle speed as required to minimize the deleterious effects attending cold weather idle conditions.

Where traction battery ESS qualified SOC permits, applicable interlocks set and HVAC system on enabled-all utilities in support of HVAC systems where ambient temperature is compliant to § TS 7.5.1.1 subpart a., the engine shall shut down no effected delay and the HVAC system shall operate electrically from the ESS source for the specified time period.

The system shall function as follows:

a.) Between 32°F and 78°F cease propulsion system operation as defined §TS 7.5.1 shutdown at five (5) minutes.

b.) At 79°F and above extend timing to 10 minutes from neutral set, normal multiplex system time out.

c.) Between 21°F to 31°F extend timing to 10 minutes from neutral set, normal multiplex system time out.

d.) At 20°F and below extend timing to 20 minutes from neutral set, normal multiplex system time out.

**TS 7.5.1.2 Override Function**

A momentary bat handle toggle switch shall be provided that disables the automatic shutdown routine. The override function shall set for one (1) master switch operating cycle at a time. Switch shall be located at AVL/AVM system cabinet. A user non-resettable counter shall be incorporated in the multiplex system logic. The counter shall log switch operations by occurrence and date. Under shutdown conditions specified by §TS 7.5.1.1 -a through d, the center/rear brake magnet valve shall be set and held extending all other multiplex (those required to maintain the magnet valve function) shutdown programming until park brake set enabled, in range selected, antitheft key switch set to run.

**TS 7.5.1.3 Control Module(s)**

All control modules shall be located in roof mounted water proof, abutment sealed type equipment apparatus boxes.

The box shall be constructed from aluminum or stainless steel, the drip edged equipped lid, shall prohibit by mechanical arrangement and gasketing the entrance of water and/or other contaminates. All cabling shall be arranged so that water or other contaminates cannot enter the enclosure. All controller(s) cabling shall be localized to the greatest extent possible at the roof area, only the drive unit and range selector shall be located within the coach. The equipment box shall be equipped with a drive and multiplex system data port(s) and a protected 12 volt cigarette receptacle as defined by § TS 7.5.2. Drive unit cabling shall be arranged as specified by § TS 7.3.3.2. The Contractor shall arrange a demarcation block or terminus that defines the electric circuits attending the vehicle. The equipment box may be physically interposed between the ESS evaporator/cooling system, and ESS unit if required to manage system controller reject heat.

All low voltage DC power circuits shall be equipped with a 24-12 volt DC converter provided to enhance voltage stabilization. The stabilizer system shall limit voltage swings on its output side (12 volt) to ± 0.50 volts @ maximum current demand with an input condition ranging from 19 to 28 volts DC.

**TS 7.5.2 Electrical Performance**

The traction inverter (DC to VFVV-poly phase current) shall be the IGBT type exhibiting high efficiency, low loss. It shall provide the energy necessary to accelerate the traction motor/coach to specified requirements and shall facilitate the necessary recuperative energy transfer to the ESS and coach/rheostatic loads upon braking.
operation. The Contractor shall provide a system that affords full authority control of acceleration to the mechanical limits of the propulsion system. Test ports for service repair validation shall be provided at the operator’s area of the coach. Fused, 12 volt, 20 amp DC cigarette style receptacles shall be provided for the operation of portable inverters required for portable test equipment and/or PC’s in the AVM test box, and any other location constituting an equipment or apparatus box or enclosure.

TS 7.5.3 Mountings
The inverter module(s)-groups shall be designed so that system and support components are logically arranged for efficient removal and replacement. All like modules shall be completely interchangeable and functionally grouped, as well as all interconnecting coach bars, connecters and terminals. Equipment weights that exceed 80# or 36kg, shall incorporate a lifting mechanism that facilitates component removal and replacement. Inverter, converter circuit control shall be arranged so as to prevent inadvertent propulsion system make-up and operation as well as the operation of converters encountering open, short circuited and other anomalous load conditions.

As an integrated unit or as separate propulsion devices all equipment containers shall be removable with a jib crane, forklift adaptor or like equipment. The Contractor shall provide the necessary slings and adaptors as specified by §TS 11.

TS 7.5.4 Safety
All inverters and converters shall be either mechanically or electrically double insulated (second order protected) to a degree that ensures complete passenger safety during all modes of operation. All propulsion and auxiliary power supplies shall be monitored for leakage currents (galvanic leakage-non zero sum). Inverters, controllers shall be arranged to monitor fugitive current loops/voltage leakage, said conditions shall cause an orderly shutdown sequence to occur. All anomalous shutdown condition(s) shall provide the operator of the coach a minimum of 30 seconds until actual cessation of prime mover, traction generator/motor of CVT. Said occurrence override shall be available as defined herein. Ordered shutdown(s) from any cause shall be reported to 3rd party devices with RTC stamping. The double-insulation can be reviewed during the design review process provided an adequate alternate method(s) are provided to achieve protection to the driver and passengers.

TS 7.5.5 Propulsion Control
The propulsion system shall maximize economy of operation, passenger comfort at the lowest cost of ownership in any customer requested mode of operation. The propulsion control unit shall provide the necessary input/output interface, control and systems regulation. The system shall monitor and report to third party devices via J1939 and/or equal message formats event data specified herein. Controller firmware, cable interfaces and software shall be windows based, all upgraded equipment and/or software shall either permit full backward compatibility or the Contractor shall provide updates to same for a period of no less than 12 years at no charge to SEPTA-this includes necessary re-training. Replacement of accelerator/brake assemblies shall be designed to permit recalibration by use of propulsion system software regimens, user interfaces shall either be graphical or numeric set up values. In regard to foot pedal interfaces the control system shall be capable of the following:

TS 7.5.5.1 Accelerator Function
i). Accelerator function shall be smooth and jerk-less throughout its travel from lift to full pedal stop. No propulsion make up shall occur other than at lift pedal condition.

ii). Under applicable kinetic conditions, the pedal control in propulsion make up, range selected-interlocks satisfied, shall apply the equivalent of 25-35% available or the maximum available energy to prescribed torque limit of recuperative brake excitation upon accelerator lift pedal condition.

iii). The pedal shall fault to a fail-safe mode when any wire or transducer function is deemed to be an illegal state of operation (open, shunted and/or drop-out). The safe mode shall apply the brake interlock and subsequently inhibit range selection. The fault occurrence shall be monitored and logged with a date, time and location stamp.

iv). The pedal assembly shall be physically arranged so that objects, dirt and other obstructions cannot interfere with its operating parts. Transducer components shall not be remote cable and conduit types.

v). The pedal assemblies (accelerator and brake) shall reside on an easily removable plate in order to facilitate removal and replacement. The connector(s) shall be the highest quality available and shall feed through to an area of the coach that is clean and dry at all times.

vi). The propulsion controller shall be able to display acceleration values in velocity/time metrics via graphical interface.

vii). The acceleration control shall be biased towards initial pedal displacement in a manner that provides positive, \(0.12 \geq x \geq 0.10\) g to 10 mph-from 10 mph to speed limit of 0.80 g acceleration.

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**TS 7.5.5.2 Brake Pedal Function**

The brake pedal shall meet the applicable performance requirements § TS 7.5.5.1, i-v and as follows:

i.) The pedal assemblies (accelerator and brake) shall reside on an easily removable plate in order to facilitate removal and replacement. The connector(s) shall be the highest quality available and shall feed through to an area of the coach that is clean and dry at all times. The brake pedal shall provide 65-75% available recuperative (total 100%) in sequence prior to activation of the pneumatic portion of the brake service valve.

ii.) The recuperative brake excitation shall be a variable output transducer or pneumatic sequenced switches-no pneumatic brake service cam switches are acceptable.

iii.) A Bendix E-6 brake valve shall be provided.

iv.) A test switch, located at the AVM equipment box, shall be provided that temporarily disables the electric portion of the brake system. The function shall reset upon coach master switch set from run to off to run.

v.) The propulsion controller shall be able to display deceleration values in velocity/time metrics using graphical interface.

vi.) Recuperative braking shall by design and necessary mechanical drive ratios be able to sufficiently delay the application of the pneumatic brake portion so as to provide the highest order of over coach efficiency and the promotion of maximum foundation brake equipment life.

vii.) The pedal shall fault to a fail-safe mode when any wire or transducer function is deemed to be an illegal state of operation (open, shunted and/or drop-out). The safe mode shall apply the brake interlock and subsequently inhibit range selection. The fault occurrence shall be monitored and logged with a date, time and location stamp.

viii.) Analog brake pressure signal shall be a direct interface type pressure to CAN J 1939 to propulsion system.
TS 7.5.6 Propulsion Inverter and Converter/Inverter Auxiliaries

TS 7.5.6.1 Heat Exchangers
Air/oil and/or oil/oil coolers shall be arranged at or near engine compartments or devices and/or utilities they support. The heat exchangers shall be designed and implemented so that no change is required for the basic life of the coach as defined by §TS 5. The mounting system shall prohibit unintended and/or deleterious operating conditions. Static bonds shall be provided. The unit(s) shall be removable and it shall not require the removal of other devices.
All propulsion related heat exchangers shall be controlled from the propulsion system as a single point of control. No alternate inputs or controls shall be permitted.

TS 7.5.6.2 Drive Unit Cooling Lines
All hydraulic cooling lines (glycol and/or oil) shall be arranged by use of manifolds and similar means. Orderly pipe system deployment(s) shall be rigidly and reliably fixed to the vehicle by means of fully engineered and manufactured mountings, split block clamps and other appliances. All hydraulic lines shall be self-purging, no sensible noise or vibration shall emit from any hydraulic system. Non rigid piping shall be utilized only where device vibrational frequencies prohibit or make unreliable rigid pipe application at a length not to exceed 18”. No fixed, and/or flexible lines are permitted to cross. All piping shall deploy as close to parallel as possible and be arranged to source or destination devices. Where piping or lines must deploy at right angles, they shall be arranged utilizing angled fittings, factory type bends-no flexible hoses. Fittings at the roof area shall be provided for system bleed. The fitting shall provide rate control and discharge through a FEMCO type fitting.

TS 7.5.6.3 Glycol Pumps, Loops, Heat Exchangers and Auxiliary Equipments

TS 7.5.6.3.1 Pumps
All pumps shall be the brushless/seal less ECDC motor type. All motor/pump assemblies shall exceed 40,000 hours or 7 years to median failure. Glycol loop units shall be panned to control lost coolant.

TS 7.5.6.3.2 Glycol Loops
Glycol loops, fittings, valves and other required fixtures shall be arranged so as permit full valve protected isolation where said system elements require removal and/or replacement for maintenance. Valve(s) shall indicate position by convention and shall be arranged to preclude inadvertent closure in service. A control system(s) shall be arranged or the systems affected and supported from the glycol loop(s) shall be intrinsically intolerant to loss of coolant and or flow. Said system(s) shall indicate and power down in advance of system damage as specified herein and elsewhere by this specification. All supporting systems shall be designed to inherently preclude chafing or degradation to piping, fixtures and appliances. All supports shall be plastic split block type.

TS 7.5.6.3.3 Heat Exchangers
Heat exchangers and convectors shall be passive (air non forced) arranged to provide maximum demand under the maximum ambient conditions set
forth this specification. Exchangers shall be arranged to facilitate necessary de-aeration and coolant conservancy. If active forced air cooling is required fans shall meet the basic requirements for ECDC (brushless DC) motors specified herein and throughout the specification.

**TS 7.5.6.3.4 Auxiliary Equipments**

All auxiliary controls shall be fully integrated to the basic propulsion system. All system conditional data, over-temperature and device states shall be contained and integrated to the propulsion system.

**TS 7.5.6.4 Fan and Auxiliary Loads Controller Application**

All fans, including heat exchanger, HVAC cooling and compressor(s) supplied by low (< 30 volts DC) or medium (230/208 VAC poly phase) voltages shall incorporate a control means whereby the slew rate of in pursuit of load response shall be less than the control process attending the inverters or converters supplying said loads. The systems shall apply a ramp pattern or a characteristic VFVV where those steps shall not cause current slew rate to exceed the conditions operating and limiting of the LVDC system converter(s) as applied by the Propulsion Supplier to the affected systems. The control rates operating and limiting shall be a negotiated system result where the Contractor shall direct the necessary technical integration and the users of the LVDC and medium voltage systems shall recognize their requirements to integrate to the basic requirements as set forth by the LVDC and propulsion supplier. Utility users shall and are required to tune and regulate their system utility requirements to those that define an overall systemic requirement and as set forth by the conversion equipment supplier and this specification.

**TS 7.6 Engine**

**TS 7.6.1 General**

All engines shall be certified for their intended application, post installation, and said installation shall be certified and endorsed by the OEM using the OEM’s standard installation evaluation/testing procedure, e.g., Cummins IQA. The HHDD engine shall be designed to operate for not less than 300,000 miles without major failure or deterioration that would render the unit unfit for revenue service. It shall provide adequate horsepower and torque to enable the bus to meet the minimum acceleration, top speed, and gradability requirements given in this specification. These requirements shall be met with all accessories at their maximum capacity. The Contractor shall consider these requirements as the minimum and the Contractor shall submit detailed performance curves for the bus for approval by SEPTA. The propulsion system shall have a design life of at least 12 years or 500,000 miles. MHDD engines that meet FTA/STURAA Test Requirements may be utilized as a Propulsion Prime Mover as applicable in § TS 7.6 and Performance Requirements § TS 7.1 (series applications only).

The propulsion system shall include the diesel and auxiliary (part of emissions module) fuel supply systems, an engine, propulsion system and a drive-train to the drive axle. It shall provide adequate horsepower and torque to enable the bus to meet the minimum acceleration, top speed, and gradability requirements.

The engine shall be fuel injected and electronically-controlled. The engine shall be well established in U.S. transit coach application with a minimum of two (2) million miles of revenue service. The engine ECM may be remotely mounted in either the engine compartment or at a location that permits ready access without the removal of any component and/or unit other than drive belt guard(s). The ECM shall not be obstructed by any other device or unit.
The engine shall meet all requirements of Section 6: Technical Specifications when operating on No. 1 or No. 2 ULSD fuel, as certified by the engine manufacturer and specified by SEPTA. The engine shall operate on #2 ULSD fuel upon physical delivery to SEPTA.

The engine shall be equipped with an electronically controlled management system, compatible with multiplex wiring systems and either 12- or 24-volt electrical systems. The engine control system shall be capable of receiving electronic inputs from the engine and other vehicle systems. Communication between these electronic systems shall be made using the SAE J1939 Recommended Practice communication link. 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 engine performance.

The engine control system shall protect the engine against progressive damage. The system shall monitor conditions critical for safe operation and automatically de-rate power and/or speed and initiate engine shutdown as needed. The on-board diagnostic system, as described in Section TS 9.6.1.8, shall trigger a visual and audible alarm to the operator when the engine control unit detects a malfunction and the engine protection system is activated.

Orderly announced automatic shutdown shall only occur when parameters established for the functions below are enabled:

- Propulsion system command
- Emissions system command
- Engine protection command
- Coolant Level
- Coolant Temperature
- Oil Pressure
- Oil Temperature
- Fire

The propulsion system shall incorporate a conditional shut regime in order to limit excessive idle per § TS 7.5.1. Upon operation of the above listed, the alarmed condition shall be reported from a text display at the operators dash board.

The engine shall have on-board diagnostic capabilities, able to monitor vital functions, store out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. Diagnostic reader device connector ports, suitably protected against dirt and moisture, shall be provided in operator’s area, propulsion system apparatus box and inside engine compartment. The on-board diagnostic system shall inform the operator via visual and/or audible alarms when out-of-parameter conditions exist for vital engine functions. Conditions that require an operator alarm are identified in Section TS 9.6.1.8.

**TS 7.6.2 Starting Aid**

The engine shall start reliably in ambient temperatures down to ten (-10 < 0) degrees below zero degrees Fahrenheit. If necessary to meet this requirement, the engine/drive system shall be equipped with an automatic ether injection system or other cold start aid such as an intake heater. The engine shall start via the hybrid drive unit.

The engine shall be equipped with an operator-controlled fast idle switch, idle speeds shall be adjusted as necessary in order to limit wet and/or carbon loading to emissions systems. The fast idle control shall be a two-way toggle or a sealed rocker switch mounted on the dash or side console and shall activate only with the propulsion system in
neutral and the parking brake applied. This device may be used to help meet the requirements of bus cool down in Section TS 9.8.

A control shall be available to the operator, to allow temporary override (active as long as set) of the engine protection/shutdown system if engine power is required to move the bus in emergency conditions. Any application of the override shall be logged to the system AVM recorder and associated data; date, time and location shall be recorded.

**TS 7.6.3 Charge Air Cooling**

The charge air cooling system (CAC), also referred to as after-coolers or intercoolers, 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 and the ambient conditions as set forth in Section TS 5.20. The charge air cooler shall be located in close proximity to the prime mover in order to limit ducting loss. Piping, couplers and fittings shall be arranged to facilitate rapid removal of components. Air ducting and fittings shall be protected against heat sources, and shall be configured to minimize restrictions and maintain sealing integrity.

**TS 7.6.4 Jerk Rate**

Jerk, the rate of change of acceleration, shall be minimized throughout the acceleration/deceleration range. These requirements shall be achieved regardless of operator actions.

**TS 7.6.5 Service**

The power plant 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 power plant. Two 3M mechanics shall be able to remove and replace the engine and propulsion system assembly in less than 12 total combined man-hours. The components of the exhaust system, air cleaner, air compressor, starter, alternator, radiator, all accessories, and any other component requiring service or replacement shall be easily removable and independent of the engine and propulsion system removal. An integrated (CAN based, single electronic unit) engine oil pressure, coolant, and oil temperature gauge and engine hour meter 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.

Engine oil and the radiator filler caps shall be hinged to the filler neck and closed with spring pressure or positive locks. All fluid fill locations shall be permanently labeled to help ensure correct fluid is added and all fillers shall be easily accessible with standard funnels, pour spouts, and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type, "FEMCO", drain plugs, of a standard size.

The engine and propulsion system shall be equipped with sufficient heavy-duty fuel and oil filters for efficient operation and to protect the engine and propulsion system between scheduled filter changes. The filters shall be of the spin-on, disposable type and/or integral with the propulsion system. All filters shall be easily accessible and the filter bases shall be plumbed to ensure correct reinstallation, all filters shall be arranged to provide necessary removal clearance and removal shall not be obstructed by wiring harness, fuel or hydraulic lines and like equipment. Fuel and oil lines shall meet the requirements of Section TS 7.6.10. The engine shall be equipped with a fuel-priming pump or a check valve fitted in the fuel suction line to aid restarting after fuel filter changes.

A DAVCO Model 384 fuel Filter system shall be installed and arranged for proper visibility and maintenance accessibility. The filter location shall be outboard perimeter curb side engine compartment and the location shall permit the filter bowl to be removed upward.
A centrifugal, permanent bypass engine oil filter unit with disposable filter element shall be provided. The unit shall be arranged to permit full maintenance access applicable to mounting as described in the preceding fuel filter section with necessary compensation for vertical upward removal of filter cartridge.

The engine shall be equipped with a dry-type air cleaner with a serviceable element of the capacity recommended by the filter manufacturer to match the engine supplied installed in a steel housing. The element shall be capable of operating in SEPTA service for a minimum of 18,000 miles or 20" of water restriction, whichever comes first before repair/replacement is necessary. The air cleaner housing shall be heavy duty steel construction and be designed to last the lifetime of the vehicle. A manually resettable filter monitor shall be provided. If a conical filter element is provided, said filter element must incorporate an alignment means to the bolted filter housing cap.

The filter shall be removable by a 3M mechanic in 10 minutes or less. The location of the air intake system shall be designed to minimize the entry of dust and debris and 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 air filter.

The engine lube oil dip stick shall be arranged to provide an accurate reading and shall be marked for hot and cold compensation. The supporting conduit shall be rigidly and permanently affixed to the engine and the dip stick gantlet shall deploy at an angle that facilitates withdrawal and insertion without interference from vehicle and/or engine mounted structures and/or devices.

**TS 7.6.6 Accessories**
Engine-driven accessories shall be mounted for quick removal and repair. Accessory drive systems shall operate without unscheduled adjustment for not less than 100,000 miles in SEPTA Service. These accessories shall be driven at speeds sufficient to ensure adequate system performance during extended periods of idle operation and low route speed portion of the design operating profile. Belt guard(s) shall be provided as required for safety and shall be sturdy in design and installation and readily removable. The belt guard(s) shall be hinged and feature “quick release” fasteners/hardware to gain access to accessories, belts, and drives. Accessories may be electrically driven.

**TS 7.6.7 Hydraulic Systems**
The hydraulic system shall have a design goal of a mean distance between repairs in excess of 300,000 miles. 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. Critical points in the hydraulic system shall be fitted with service ports so that portable diagnostic equipment may be connected or sensors for an off-board diagnostic system permanently attached to monitor system operation. All hydraulic lines shall meet the requirements of Section TS 7.6.10, and all elements of the hydraulic system shall meet the noise limits defined in Section TS 5.21. A tamper-proof priority system shall prevent the loss of power steering during operation of the bus if other devices are also powered by the hydraulic system. All elements of the hydraulic system shall meet the accessibility loading requirements of Section TS 9.5.4.2 and requirements specified by § TS 7.5.6.2.

**TS 7.6.8 Fluid Lines, Fittings and Clamps, and Charge Air Piping**
All fluid lines and air piping shall be rigidly supported to prevent chafing damage, fatigue failures and tension strain. Lines passing through a panel, frame, or bulkhead shall be protected by grommets (or similar device) that fit snugly to both the line and the perimeter of the hole that the line passes through to prevent chafing and/or wear. All lines that pass through a bulkhead that constitutes a firewall shall utilize fireproof bulkhead fittings to prevent
propagation of fire. The installation will be evaluated on the Pilot Bus Inspection. The installation must not have kinks, twists or bends that place a strain on the respective line(s).

Flexible fuel and oil lines shall be kept at a minimum and shall be as short as practicable. Flexible lines shall be routed or shielded so that failure of a line shall not allow fuel or oil to spray or drain onto any component operable above the auto-ignition temperature of the fluid. Flexible lines shall be premium hoses as required and shall have standard SAE or JIC brass or steel, swivel, end fittings. Flexible hoses and fluid lines shall not touch one another, or any part of the bus. The installation will be evaluated on the Pilot Bus Inspection. The installation must not have kinks, twists or bends that place a strain on the respective line(s).

Lines shall have a maximum length of six (6) feet unless demonstrated inappropriate for a given application. Hoses/lines shall be secured with heavy-duty stainless steel, full silicone rubber clamps.

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

**TS 7.6.9 Radiator Lines**
Radiator piping shall be stainless steel (high carbon stainless steel not acceptable) or brass tubing and, if practicable, hoses shall be eliminated. Necessary hoses shall be premium, silicone rubber type that is impervious to all bus fluids. All hoses shall be as short as practicable. All hoses shall be secured with premium, stainless steel worm drive, wide band type clamps that provide a complete 360° 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. Vertical or elevation piping shall be split block clamped and transfer through bulkheads or structure using flanged or like fully engineered couplings. Roof mounting of radiators shall require foot/check valves and all other necessary devices, fittings and/or appliances required to effect proper operation and replacement of system components without air entrapment or other hydraulic conditions that would cause interference or reduction of capacity in operation.

**TS 7.6.10 Oil and Hydraulic Lines**
All lines shall be compatible with the fluid carried and maximum pressures of the system. Flexible lines shall be minimized in quantity and length. Lines of the same size and with the same fittings as those on other piping systems of the bus, but which are not interchangeable, shall be marked or tagged for use on the hydraulic system only. Hydraulic lines shall be individually and rigidly supported to prevent chafing damage, fatigue failures, and tension strain on the lines and fittings.

**TS 7.6.11 Engine/CAC and Auxiliary Cooling Fan System**
An electrically operated and controlled fan system shall be provided. The fan control system shall receive CAN and/or PWM data from the primary engine control system. Close loop compensation feedback shall be incorporated.
All hydraulic temperature loops shall be available for direct reading in degrees F at a maintenance message display terminal. The maintenance message display terminal shall be located in the AVM/AVL cabinet.

**TS 7.6.12 Fuel Lines**
Fuel lines shall be rated and sized to prevent freezing and plugging due to condensation and/or fuel gelling in extreme weather.
All fuel lines forward of engine bulkhead shall be corrosion-resistant stainless steel tubing or SAE Standard J844 for nylon tubing color coded yellow. All fuel lines aft of engine bulkhead shall be stainless steel jacketed, nylon core or equal. No copper lines or fittings are permitted in the fuel system.

**TS 7.6.13 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 minimized. The bend radii should be maximized to meet the pressure drop and temperature rise requirements of the engine manufacturers. The cross section of all charge air piping shall not be less than the cross section of the intake manifold inlet. Any changes in piping diameter shall be gradual to ensure a smooth passage of air and to minimize restrictions. Piping shall be routed away from exhaust manifolds and other heat sources, and shielded as required to meet the temperature rise requirements of the engine manufacturer.

All offset hoses and main CAC duct work shall be wire or equal reinforced. All clamping shall be the constant tension type. All ducting shall be properly supported with vinyl coated or equal, covered over metal clamps. All duct work shall permit thermal and other force loading without fatiguing and/or separation under normal operation.

Charge air piping shall be constructed of either stainless steel, aluminized steel tubing or anodized aluminum. Connections between all charge air piping sections shall be sealed with a short section of reinforced hose and stainless steel, constant tension clamps that provide a complete 360° seal.

**TS 7.7 Engine Cooling System**

**TS 7.7.1 General**
The temperature of the main engine, propulsion and other loads imposed upon the cooling system and operating fluids on the bus shall be controlled by a cooling system. The cooling system shall be equipped with a removable coolant filter that also provides for the addition of supplementary coolant additives into the system. The cooling system shall be sized to maintain fluids at safe, continuous operating temperatures during the most severe operations possible with the bus loaded to GVWR, a fifty percent (50%) centered blockage of the front of the radiator or ten percent (10%) with a two cross flow roof-mounted radiator, and ambient temperatures from - 20°F up to 110°F. Radiator heat reject performance shall be based on a maximum ambient condition @ 120°F and a maximum engine temperature of 205°F. The coolant shall meet all applicable engine OEM specifications and be commercially available in the United States. The contractor shall document and submit all applicable coolant product information to SEPTA during the pilot phase. The radiator cooling fan shall be thermostatically controlled. SEPTA shall waive the fifty percent (50%) radiator blockage requirement for a radiator which has no more than ten (10) fins per inch of the type as defined within this specification.

**TS 7.7.1.1 Engine Cooling**
The engine shall be cooled by a water-based, pressure type, cooling system that does not permit boiling or coolant loss during the operations described above. Engine thermostats shall be easily accessible for replacement. Shutoff valves shall allow filter replacement without coolant loss. Valves shall permit complete shutoff of lines for the heating and defroster units, and water booster pumps. The water boost pump shall be a magnetically coupled, Brushless design. All low points in the water-based cooling system shall be equipped with drain cocks. Air vent valves shall be fitted at high points in the cooling system unless it can be demonstrated that the system is self-purging. Surge tank vent lines shall be #6, Teflon lined hoses and shall be insulated from other heat rejecting sources.
A correctly sized expansion tank shall be provided. If engine cooling system requires a segregated or isolated main engine to auxiliary coolant heat exchanger, the Contractor shall ensure the mechanical arrangement of equipment supports accessibility in support of inspection and maintenance.

Pressure regulation shall be by dedicated, (no integrated pressure cap valve shall be installed) high quality special purpose valves intended to provide the best system regulation reliability.

A sight glass tube to determine satisfactory engine coolant level shall be provided and shall be accessible by opening one of the engine compartment's access doors. The sight glass tube shall be protected by a metal frame around the tube to prevent breakage. A spring-loaded, push button type valve to safely release pressure or vacuum in the cooling system shall be provided with both it and the water filler no more than 60 inches above the ground and both shall be accessible through the same access door.

The radiator, shall be of durable corrosion-resistant construction with bolted-on, cramped removable tanks, or welded tanks. All solder used in the radiator shall be lead free and the radiator shall have a maximum of ten (10) fins per inch. Fins shall be of a flat design with hemmed outer faces to increase bending resistance. The finplate may be dimpled-it shall not be ridged or pented and/or corrugated in a manner that would serve to improve efficiency at the cost of service maintainability.

All plumbing and wiring shall be arranged to facilitate removal by incorporation of necessary disconnect means, plugs and/or couplings. The Contractor shall provide core samples of the radiator it intends to use prior to manufacture of Pilot Vehicle. The radiator shall be designed so a 2M mechanic can gain access to a substantial portion of the side facing the engine for the purpose of cleaning the radiator in five minutes or less. The radiator shall be suitably protected from Road Dust, Dirt and Debris such that it will not require cleaning at less than 12,000 mile intervals in SEPTA service. The radiator access door shall be designed and manufactured in a way that prohibits the accumulation of dirt and debris from reaching the radiator/heat-exchanger and charge air cooler (CAC) unit. Proper sealing shall be provided in order to prevent air flow shunting and/or bypass between the access door and primary heat exchange surfaces.

Radiator piping shall meet the requirements of Section TS 7.6.9. No heat producing components or climate control system components shall be mounted between the engine cooling air intake aperture and the radiator. The radiator and charge air cooler shall be designed to withstand thermal fatigue and vibration associated with the installed configuration.

The engine cooling system shall be equipped with a properly sized coolant filter with a spin-on element.

The electrically driven cooling fans shall be temperature controlled, allowing the engine to reach operating temperature quickly. The fan speed shall be regulated to provide effective power plant cooling and to minimize noise. The temperature-controlled fan shall not be driven (no output torque) when the coolant temperature falls below the minimum level specified by the engine manufacturer.

**TS 7.7.1.2 Roof Mounted Cooling Provision**
Where roof mounted or arranged radiator/charge air and auxiliary coolers are provided they shall meet the following additional requirements:

- All piping shall be straight line and arranged as to prevent crossing and deployed in a manner that permits inspection and removal without removing other fixed units. All fixing mounts and couplers shall be accessible and removable from the engine compartment.
b.) All pipes shall be supported using antichafe splitblock clamps in support of vertical and lateral approaches.

c.) Piping system shall permit basic operation of units operating at expected phase and displacement shifts to be properly maintained for a minimum of 12 years or 350,000 service miles.

d.) All couplings shall be of the best in trade grade using fully engineered formed silicon couplers and constant tension clamps.

e.) Coupled tubes shall have full beading at 30mm distance from tube ending and the end form shall prevent cut through or degrading service conditions.

f.) Piping shall be sufficiently rigid for service and maintenance requirements.

g.) CAC inlet and outlet pressure test ports shall be provided.

h.) An engine compartment radiator pressure gauge shall be provided.

i.) A internally regulated pressure fill system shall be provided. The system controlled fill rate shall be designed to permit coolant charging and proper displacement of air from the surge (conservator) tank. The fill system shall indicate said requirement by employment of a labeled conspicuous LED indicator (w/built in lamp test) located in the engine compartment indicating at10% above the aeration level and as required by the engine manufacturer application practice. The system PID control shall permit charging above the coolant sensor at 2 quarts minimum. The fill system shall employ and dry break coupler of a type to be specified by SEPTA (Eaton pt# B3K21). The system shall upon activation from a dedicated engine compartment electric switch activate a series of supervised solenoid valve(s) in order to permit charged coolant to displace surge tank accumulated air.

j.) The valves and manifold shall be located in the engine compartment ground level for inspection and maintenance purposes. The surge tank purge solenoid shall direct exhaust to a 1 quart vented/removable plastic holding container for reclaim. Solenoid valves shall be equipped with momentary manual bypass systems.

k.) A pressure transducer shall be arranged to monitor the engine coolant pressure. The system shall incorporate temperature algorithms that enable proper monitoring sequences.

TS 7.7.2 Mounting
The power plant shall be a rear drive in-line configuration (T-Drive). All power plant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure as defined in Section TS 9.1.5. Mounts shall control movement of the power plant so as not to affect performance of belt driven accessories or cause strain in piping and wiring connections to the power plant. The engine shall be mounted to provide maximum isolation of audible frequencies in the range of 35 to 275 Hertz. The engine cradle (if equipped) shall not interfere with the removal of the engine and propulsion system components and accessories. All parts shall be interchangeable.

TS 7.7.3 Diesel and DEF Fuel System
Fuel Containers – Tank(s)
All functional and/or fuel system elements in contact with fuel shall be biodiesel, B-20 (ASTM D6751) rated. DEF tanks shall be mounted and fixed to vehicle structure utilizing mounting boss(es) or clamps directly to base flanges. No resilient or sprung strapping or saddling is permitted. The tank shall not yield no force(s) applied from filling. The fill cap shall be arranged with captive hardware. The fill cap and thread mountings shall be serviceable as a separate unit.

TS 7.7.3.1 Operating Range
See Section TS 7.1.5.

TS 7.7.3.2 Fuel Capacity
A single stainless steel fuel tank shall have a total minimum capacity of 120 gallons. The useable amount of fuel shall be no less than 92% of the capacity of tank.
The DEF system shall be proportioned to permit necessary filling to occur at a frequency 2 times less than the diesel fuel fill.

**TS 7.7.3.3 Design and Construction**
The fuel tank shall be equipped with an external, hex head, B-20 compatible drain plug. It shall be at least a 3/8-inch size and shall be located at the lowest point of the tank, it shall not corrode or degrade in any way that renders it unfit for its intended service. The fuel tank shall have an inspection plate or easily removable filler neck to permit cleaning and inspection of the tank without removal from the bus. The tank shall be baffled internally to prevent fuel-sloshing noise regardless of fill level. The baffles or fuel pickup location shall ensure continuous full power operation on a 6 percent upgrade for 15 minutes starting with no more than 25 gallons of fuel over the unusable amount in the tank. The bus shall operate at idle on a 6 percent downgrade for 30 minutes starting with no more than 10 gallons of fuel over the unusable amount in the tank. The fuel tank pick up and returns shall be properly arranged so that returned fuel is properly cooled. Auxiliary tank pick-ups shall be easily maintained. Access openings from the interior of the vehicle for the fuel tank shall be provided. The opening(s) shall be positioned to provide easy access to the fuel filler neck assembly and tank pick up for service/replacement. All interior fuel tank access openings shall be equipped with a reusable die cut gasket that shall maintain adequate sealing against vapor and/or liquid intrusion to the passenger areas of the vehicle. All interior tank access covers shall be equipped with reusable attachment hardware. All fuel tank appliances shall be designed in a manner that prevents fuel from accumulating at or near any horizontal surface of the tank. The fuel tank shall be made of corrosion resistant stainless steel. Fuel tank appliances shall be arranged so they are fully accessible and removable without any repositioning of the fuel as installed. Tank appliances e.g., fill neck castings, level control and whistle and pressure relief valve and sundry appliances shall be equipped with orderly and well deployed rigid pipe-work arranged to conduct all vapor and/or fluids expelled from said appliances to below the lower tank floor level.

The fuel filler shall be located on the curb side at a location to be approved by SEPTA. The filler shall have a minimum fill rate of forty (40) gallons per minute of foam free fuel without spitting back or causing the nozzle to shut off before the tank is full to its usable capacity. An audible signal shall indicate when the tank is full. The fuel neck assembly shall be Emco Wheaton Posi-Loc Model 105.

**TS 7.7.3.4 DEF Supplemental System**
The DEF system shall be arranged with a fill door and coupling at height no greater than 60” from leveled ground. The system shall incorporate a fill door, fill neck, fill indication required/filled limit obtained means. The nozzle system shall not be interchangeable with the diesel fuel fill system. The DEF supplemental fill system shall be a pressure type arranged to accept wayside pump delivery from 15 to 25 PSI. The system shall consist of a fill station quick disconnect (part number specified at Pilot Bus Inspection) and said delivery bib and supporting structure shall be immune from damage caused by de-minimis release of said DEF fluids. The contractor supplied DEF fluid storage tank shall be capable of autonomous storage of 620 miles of DEF fluid at CBD operating cycles. The fill bib area shall be arranged with a drainage system diverting de-minimis discharge from staining and/or causing damage to exterior doors and panels, exterior body panels and all other surround and support structures, devices, equipment and operating systems. The DEF fluid control system shall be arranged to stop wayside fill by means of a control solenoid that shall close upon proper fill level. The tank shall prevent overfill or pressure rise beyond its design. The DEF fluid system shall indicate fill required by means of dash lamp at the operator’s area, a fill lamp at the DEF fill bib area (lamp flashes until level is satisfied then turns solid) and any anomalous condition shall report to 3rd party devices-AVM system.
TS 7.7.3.5 Installation
The fuel tank shall be securely mounted to the bus to prevent movement during bus maneuvers, but shall be capable of being removed and reinstalled by a 2M mechanic for cleaning or replacement in 2.5 hours or less.

TS 7.7.3.6 Labeling
The capacity, date of manufacture, manufacturer name, location of manufacture, and certification of compliance to Federal Motor Carrier Safety Regulation shall be permanently marked on the fuel tank. The markings shall be readily visible and shall not be covered with an undercoating material.

TS 7.7.3.7 Fuel-Focus System
A fuel dispenser authorizing system shall be provided. The system shall be supplied by Asset-Works, the system shall be Fuel-Focus OBDII/J1939, RID-56-GEN-RF1-MAX.

The pickup unit shall be installed at the filler neck area, the pickup unit shall be arranged with suitable oil/fuel resistant disconnect means. The pick up (ID Tag transponder) shall be serviceable without the removal of any of the fuel tank parts, vehicle structure or sheet metal.

The RF antenna shall be located and oriented in order to ensure proper operation as close to the FR ID box as possible in a protected interior space. The Fuel-Focus controller shall be located in the IVS equipment box.

The Contractor shall at customer acceptance of all production vehicles demonstrate the complete functionality of the system by use of suitable wayside device emulation, said emulation proving the proper and complete operability from ID tag trigger to server (or emulation of same) that system recognition and through put are complete and that transacted data is reliably and accurately delivered to the wayside server.

The RF ID box shall be located at an apparatus or equipment box, arranged for inspection and removal/installation without the removal of other equipment.

Transactions shall consist of the following:

i-Day.
ii-Date
iii-Time
iv-Vehicle ID number
v-Odometer, mileage reading
vi-Engine hours
vii-Fuel gallon dispensed
viii-Location and pump number

The Contractor shall program and test the system prior to and during customer acceptance at their production plant.

The Contractor shall provide eight (8) emulation test devices for programming and performance verification.

TS 7.7.4 Final Drive/Rear Axle

TS 7.7.4.1 Intermediate and Final Drive
The intermediate and final drive system shall consist of a drive shaft, intermediate reduction gearings (if not housed at the traction motor or final drive), drive shaft-mounting flanges and final reduction components. The drive system shall meet the following requirements:

i) Torsional accelerations shall not exceed 400 Rad/sec/sec as measured at normal ride height.
ii) Inertial accelerations shall not exceed 900 Rad/sec/sec as measured at normal ride height.
iii) Contractor shall provide driveline data based on calculated values. The data shall be submitted to SEPTA as part of required engineering documents.
iv) Drive shaft shall be balanced to ISO 1940/1 G16 max. Contractor shall submit certification.

**TS 7.7.4.2 Final Drive Mechanical and Rear Axle**

The drive axle shall be single stage or two stage, non-hub reduction ZF or MAN. The drive axle shall be disk brake equipped. The coach shall be driven by a single heavy-duty axle at the rear with a load rating sufficient for the coach loaded to GVWR while meeting the power/load shear requirements specified herein. Transfer of gear noise to the coach interior shall be minimized. The drive axle shall be designed to operate for not less than 350,000 miles on the design operating profile without replacement and/or major repairs. The lubricant drain plug shall be "FEMCO" quick-change type. The drive shaft shall be guarded to prevent it striking the floor of the coach or the ground in the event of a coupler, tube or universal joint failure. The drive shaft guard shall be a loop or structure that is of sufficient strength to contain the drive shaft during failure modes. Proper venting shall be provided and it shall be sufficiently well constructed so as not plug, kink or become otherwise degraded. The vent line shall be 1/4" ID minimum tubing and the run shall not exceed 5 feet with no more than 170° of curvature.

i) The final drive shall by design, fabrication and proper application not emit noise/vibration that is particularly noticeable when operating to its designed balancing velocity. The noise shall not be sufficiently narrow banded and/or of a quality where harmonic content shall generate or otherwise be the cause audible coupling (resonate) with other coach component(s) and/or systems.

ii) The drive shaft area shall be fitted with a fully framed, integrated floor hatch system. The floor opening shall be greater than 4" in length over the installed drive shaft length with an aspect ratio not to exceed 3 to 1 length to width. The floor cover shall be fixed to the integrated floor frame by 6, ¼ turn 5/16” flush mounted drive cams. The floor cover and frame shall preclude vapor, dust and sundry debris from entering the passenger area of the coach. In terms of durability, the floor frame shall be designed and applied as a basic structural element. The floor frame and cover shall not degrade from dirt, chemical and/or pressure cleaning. All metal parts shall be stainless steel, all floor elements and covers shall be fully integrated and they shall not degrade during the operating life of the bus.

iii) A drive shaft safety bar shall be provided. The drive shaft safety bar shall be arranged to support the drive shaft when removed from the differential carrier flange by means of a metal strap that can be applied to the hanger so that the suspended drive shaft shall clear the orbit of the differential carrier during a tow service operation. The safety bar shall be permanently attached to the vehicle and swing into a positively locked, stored position when not in use.

**TS 7.7.5 Emissions Systems Module or Alternate Configuration**

**TS 7.7.5.1 General**

The following exhaust system and after treatment components in the aggregate, shall be considered in physical and functional sense, a unit or module, in regard to its installation, serviceability and operating means. The elements, exhaust system and couplings and outrace exhaust pipe(s), DOC and couplings, NOx reactor and couplings; sensors, controllers, pumps if applicable, and sub frame shall be arranged as a unit that shall be easily removable and serviceable from the coach through the rear access hatch. It shall comprise a 44” by 88” rear advertising panel.
The unit or module, shall consist of a frame work the supports the operating components in functional laterally arranged order that also permits said components to be easily removed from either the in-chassis or offsite maintenance activity. The components may be saddle or tab mounted, the requirement shall be the orderly and efficient removal, repair and/or replacement of system components, including sensors, controllers, and all other constituent parts.

The emissions system shall report user defined operational and functional data to 3rd party AVM, message display terminal and local user port.

The modular emission system shall be located in a space above the engine or in the area street side lower engine compartment formally occupied by the coolant system radiator.

**TS 7.7.5.2 Emission Systems Surround Structure**
The emission system after treatment device enclosure shall be suitably thermally insulated and protected by a structure designed to limit collateral damage from system malfunction. Heat shields shall be arranged preventing damage to all surrounding equipment, other parts of the emissions system and all other devices, harnesses or objects. The heat shielding shall be effective in all operating modes. The structure shall incorporate an auxiliary thermal sensor(s) that when satisfied shall initiate localized (upper engine compartment only) fire control regimes and orderly shutdown with attendant 3rd party device logging and override regimes. All exterior body panels surrounding the emissions systems devices shall be hinged and removable using a 5/16” square key. If by design and manufacture a rear lamp or like panel is by location part of the emissions zone, the Contractor shall ensure that no conduction, radiation or convection shall cause any measurable elevation to temperature for lighting appliances or associated wiring harnesses.

**TS 7.7.5.3 Emission Systems Mounting(s)**
The emissions mounting(s) shall be arranged to facilitate the quick change out of the maintenance portion of all operating parts of the system. The mounting components shall be arranged on a sub frame that requires no more than 4 fixing points located to the main chassis or frame that facilitates/permits the emissions system unit to be withdrawn from the aforementioned rear coach hatch by means of integral, blind fork lift pockets. The unit shall be mechanically arranged so that upon release of necessary exhaust component couplings the unit shall have sufficient lateral clearance to said coupling(s), upon lateral clearance obtained, withdrawal from the coach may proceed axially. The emission system couplings shall be band clamped and designed for removal and make up without requirement of undue force which would tend to deform and/or permanently damage or render said components unfit for reuse. The clamps and associated gaskets shall be removable and renewable at 0.25 man hours. The unit removal/installation shall not be encumbered by vehicle structure-no parts other than the door shall impede the R&R of the maintainable parts of these filters. The access door shall be designed and arranged to open, propped to nearly vertical as not to limit lift truck approach and access to emissions module. All auxiliary equipment; wiring harnesses, fluid lines shall be arranged with disconnects, plugs and receptacles that permit easy unit removal and replacement. The access door shall meet the general fire retardant requirements of § TS 5.24 and TS 9.1.6. The Contractor shall supply a video demonstrating the removal and replacement of the unit due at Pilot Delivery.

**TS 7.7.5.4 Emission Systems Shipping Containers**
The Contractor shall supply sixty (60) high density double wall plastic, stackable-interlocking shipping containers designed to safely transport the filter units during maintenance removal and transportation procedures. The filter units shall be equipped with suitable handles or grips designed to ensure safe handling and reduce the lifting stress imposed on maintenance personnel.

**TS 7.7.5.5 Emission Systems Data Recording Requirements**
The emissions system shall be equipped with a data logger system that shall record the operating, maintenance and system fault occurrences. The data logger may be part of the propulsion system as a virtual device. The data logger shall gather local and other attendant corroborating data required to affect a system that provides a complete profile of normal, maintenance and fault modes. The data shall be exported through CAN, J1939 message telegrams to all system users as well as local port, message displays and 3rd party AVM devices.

**Indication and Function Switches**

All data date and time stamped, GPS system referenced. The data logger shall be linked to the emissions module by serial number through a local processor. The event logger may be reset upon the application of an external software key supplied by the Contractor. The intention of the keyed reset is to obtain said reset upon either rehabilitation and/or renewal of system components.

The emission system data logger shall log and route the following data:

- Number of system operating hours
- Number of system operating hours at various condition levels, 1-4 as defined by engine manufacturer.
- Number of system regeneration request/obtained/interrupted.
- Number of manual (switch activated over rules) requested/obtained.
- Emission module serial number.
- System reset date and employee number (employee number field required)
- System operating metrics shall be viewable upon requested port.
- System fault codes.
- Log propulsion/engine system requests

The emission system function switch(es) shall be located at the AVM cabinet. The switch shall be a bat handle sprung centered return arranged as follows:

1. Switch centered = normal operating mode.
2. Switch up = Regeneration inhibit-one master switch, front run not selected or battery switch cycle.
3. Switch down = Force regeneration.

**TS 8. Chassis**

**TS 8.1 Suspension**

**TS 8.1.1 General**
The front and rear suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Normal replacement items, such as a suspension bushing, shock absorber, or air spring shall be replaceable by a 3M mechanic in 30 minutes or less. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Necessary adjustments shall be easily accomplished without removing or disconnecting the components.

The Contractor shall provide fully integrated access plates that shall permit the inspection and replacement of fixing hardware for suspension bellows (air springs) and upper shock mountings. Stainless steel plates, utilizing applied material specified herein for flooring shall be arranged through application of permanent nut inserts shall be provided. The floor plane shall be counter bored to receive a perimeter abutting seal designed to prohibit the entrance of dirt, dust, water and other contaminants.
TS 8.1.2 Springs and Shock Absorbers

TS 8.1.2.1 Travel
The suspension system shall permit a minimum wheel travel of < 2.5 inches jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and 2.5 inches 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. Radius rods and other stabilizing devices shall be provided as necessary at the axles to control lateral, longitudinal and torsional movement of the suspension system. 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 1/2 inch at any point from the height required in Section TS 6.7. The valves shall have a damping or compensating feature to prevent excessive consumption of air during rapid axle fluctuations. If high flow height control valves are used the valve linkage shall be designed to minimize out of dead band operation during normal service axle jounce and rebound conditions.

TS 8.1.2.2 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. The front axle shall be equipped with two (2) heavy duty shock absorbers. Components shall be properly rated in order to provide necessary control and maximize/extend life of the absorber(s) and suspension components. Two heavy duty hydraulic shock absorbers shall be provided on each side of the drive axle. Damping shall be sufficient to control coach motion to 3 cycles or less after hitting road perturbations. Shock absorbers shall maintain their effectiveness for at least 60,000 miles of the service life of the bus. Each unit shall be replaceable by a 2M mechanic in less than 15 minutes. The shock absorber bushing shall be made of elastomeric material that will last the life of the shock absorber. The bus manufacturer shall specify end of life replacement in miles.

TS 8.1.2.3 Lubrication
All elements of steering, suspension, and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534. These fittings shall be located for ease of inspection, and shall be accessible with a standard grease gun without flexible hose end from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. Lubricant specified shall be standard for all elements on the bus serviced by standard fittings. Grease fitting extensions may be necessary. All foundation brake grease points shall be arranged with extension hoses and said equipment shall terminate to dedicated brackets located inboard at the lateral axle plane. Front axle upper king pin bushings shall be provided with extension piping and/or hoses permitting ease of lubrication from underneath the vehicle.

TS 8.1.2.4 Kneeling
A kneeling system shall lower the entrance(s) of the bus a minimum of 2.5 inches during loading or unloading operations regardless of load up to GVWR, measured at the longitudinal centerline of the entrance door(s), by the driver using a three position, spring loaded to center switch. Downward direction will lower the bus. Release of switch at anytime will completely stop lowering motion and hold height of the bus at that position. Upward direction of the switch will allow the system to go to normal floor height without the driver having to hold the switch up. The kneeling control shall be disabled when the bus is in motion.

TS 8.1.2.4.1 Kneeling Control Function
Upon operation of the kneeler switch from off state to Lower command:
The vehicle if in range obtained set shall switch from range obtained to neutral (auto-neutral). Range selection shall be inhibited. The magnetic brake interlock shall set and hold. The throttle shall be inoperative—shall not permit the application of throttle to the propulsion system.

**Upon operation of the kneeler switch from off state to Raise command:**
Raise command shall be inhibited prior to application of service brake pressure. Service pressure value shall be defined by § TS 7.5.1 System Function(s).

Range selection re-activates upon normal ride height obtained and service brake pressure maintained.

Brake interlock shall release upon range selected obtained.

The bus shall kneel at a maximum rate of 1.25 inches per second at essentially a constant rate. After kneeling, the bus shall rise within 2 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 acceleration shall not exceed 0.2g and the jerk shall not exceed 0.3g/sec.

An indicator visible to the driver shall be illuminated until the bus is raised to normal ride height. 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, minimum 2.5” diameter, amber lens shall be provided that will blink when kneel feature is activated. Kneeling and kneeling recovery shall not be operational while the wheelchair ramp is deployed or in operation.

If full curbside kneeling is required to meet ADA Wheelchair Ramp Slope Requirements, the manufacture shall provide an additional kneeling light and signage at the rear passenger door.

**TS 8.1.3 Wheels and Tires**

**TS 8.1.3.1 Wheels**
Wheels and rims shall be hub-piloted with 2-sided brush finish aluminum rims and shall resist rim flange wear. Wheels shall have a dura-brite, or Septa approved equal coating. All wheels shall be interchangeable. All wheel assemblies shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986. One spare wheel shall be supplied for each bus purchased by SEPTA under this Contract.

**TS 8.1.3.2 Tires**
Tires shall be furnished by SEPTA, and they shall be mounted by the vehicle Contractor. The tire load range shall be adequate for the GVWR of the bus. SEPTA shall not be responsible for shipping tires outside of the 48 contiguous United States and the contiguous Canadian provinces. Tires shall be 305 Aspect Ratio.

**TS 8.2 Steering**

**TS 8.2.1 Front Axle**
The front axle shall be a solid beam type, disk brake equipped, with an appropriate axle weight rating for the design capacity of the bus. The front axle shall be equipped with oil type hubs wheel bearings and seals. The basic suspension system (non-wear components) shall last the life of the bus without major overhaul or replacement.

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

**TS 8.2.2 Strength**
Fatigue life of all steering components shall exceed 1,000,000 miles. No element of the steering system shall sustain a Class I failure when one of the tires hits a curb or strikes a severe road hazard.

**TS 8.2.3 Turning Radius**
Outside body corner turning radius for a standard configuration 40-foot long bus shall not exceed 44 feet.

**TS 8.2.4 Turning Effort**
The steering wheel shall be no less than 20 inches in diameter and consist of synthetic Resin or Plastic construction with a metal core. The steering wheel shall be removable with a standard or universal puller. The steering column shall have full tilt and telescoping capability allowing the operator to easily adjust the location of the steering wheel.

Hydraulically assisted power steering shall be provided. The steering gear shall be an integral type with flexible lines eliminated or the number and length minimized. Steering torque applied by the driver shall not exceed 10 foot-pounds with the front wheels straight ahead to turned 10 degrees. Steering torque may increase to 70 foot-pounds when the wheels are approaching the steering stops. Steering effort shall be measured with the bus at GVWR, stopped with the brakes released and the engine at normal idling speed on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure. Power steering failure shall not result in loss of
steering control. With the bus in operation the steering effort shall not exceed 55 pounds at the steering wheel rim and perceived free play in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

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

**TS 8.3 Brakes**

**TS 8.3.1 Service Brake**
The braking system as applied shall not generate discernible noise or vibration in any operating mode or circumstance.

**TS 8.3.1.1 Actuation**
Diaphragm equipped air disk brakes, (ADB) service brakes shall be controlled and actuated by a compressed air system on all axles. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 70 pounds at a point 7 inches above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver’s heel when foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. A microprocessor controlled Automatic Braking System (ABS) and Automatic Traction Control (ATC) shall be provided. The microprocessor for the ABS/ATC system shall be protected yet in an accessible location to allow for ease of service. The total braking effort shall be distributed between all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations.

Actuation of ABS and/or ATC shall override the operation of the brake recuperative system. The dynamic braking function shall automatically reset upon cessation of ABS/ATC active condition. The dynamic braking lamp shall flash during suspended recuperative operation.

The ADB system shall be equipped with an electronic pad wear indicator system. The system shall permit the customer to define the wear limit above manufacturer absolute value as well as indication for the absolute warning. The system reporting shall be available to maintainers at the message display terminal in the manner defined for maintainer level reporting. The system shall report to third parties devices.

The Contractor shall check the maximum braking efficiency at weight with a full complement of fuel, oil, water; without passenger load; within governed reservoir pressure and with a Tapley or electronic equivalent decelerometer on each bus scheduled to be weighed. All vehicles shall be capable of panic-stopping at a speed of twenty (20) miles per hour in less than twenty two (22) feet without loss of control of the vehicle. Tapley Test Equipment or equal will be used to verify the stopping distance.

**TS 8.3.1.2 Braking Equipment**

**TS 8.3.1.2.1 Brake Design**
Brakes shall be applied by single and dual diaphragm pneumatic actuators as required. The brake caliper shall be a mono-block design utilizing integral de-adjusters and clip pad hold down springs. Or equal proposals must provide full maintenance manuals as well as meeting the electronic measurement requirements specified herein.

**TS 8.3.1.2.2 Brake Blocks**
All brake blocks shall be supplied with their respective FMSI numbers and certified as complying with FMVSS #121. The Contractor shall recommend a minimum of two (2) brake pads of different manufacture that meet all applicable regulations and performance requirements as replacement linings. The replacement linings shall be recognized as equivalent linings by the axle O.E.M. Brake pads recommended shall be non-asbestos and shall provide frictional material life as referenced in WR 1.1.1.5.1 when running on the City Transit Division portion of the Designed Operating Profile with brake retarder operating. The Contractor shall make no exclusionary agreements with the brake lining suppliers that would in any way inhibit SEPTA’s ability to procure the material offered by the brake lining supplier on the open market.

**TS 8.3.1.2.3 Brake Chambers**
The brake chamber shall have a water drain hole at the bottom in the unpressurized side. Diaphragms shall be neoprene. The brake chamber shall be mounted or protected such that the water will not tend to run into the brake actuating rod. At all modes and conditions of operation, the brake push rods must operate without mechanical interference at the brake chamber.

**TS 8.3.1.3 Service Brakes**

**TS 8.3.1.3.1 Brake Application Valve**
The Contractor shall mount the valve so that it is easily accessible for maintenance. The brake valve shall be mounted on a removable plate that permitting valve service/replacement from inside the vehicle. The brake valve shall be the Bendix E-6 type. The brake valve and accelerator pedals shall be mounted in a manner that permits easy access to all air and electrical connections. The mean time to repair/replace shall be less than 0.5 hours.

**TS 8.3.1.3.2 Brake Lining Gauge**
Brake linings shall be inspectable from under the coach. If the system is not visually inspectable, then gauges or other positive means shall be provided by the Contractor at one tool per delivered bus. The method of inspection and tooling shall be subject to SEPTA’s approval at the PILOT INSPECTION.

**TS 8.3.1.4 Hub and Disk**
Replaceable wheel bearing seals shall run on replaceable wear surfaces or be of an integral wear surface sealed design. Wheel bearing and hub seals shall not leak or weep lubricant for 100,000 miles when running on the design operating profile.

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

**TS 8.3.2 Parking/Emergency Brake**
The diaphragm equipped parking brake shall be a spring-operated system, actuated by a valve that exhausts compressed air to apply the brakes. The parking brake may be manually enabled when the air pressure is at the operating level per FMVSS 121. An emergency brake release shall be provided to release the brakes in the event of automatic emergency brake application. The parking brake valve button will pop out when air pressure drops below requirements of FMVSS 121. The driver shall be able to manually depress and hold down the emergency brake release valve to release the brakes and maneuver the bus to safety. Once the operator releases the emergency brake release valve, the brakes shall engage to hold the bus in place. An audible tone or beeper shall set upon vehicle shutdown when master switch set to OFF/PARK BRAKE not applied. Set alarm shall be active until Park Brake application is made.
TS 8.4 Pneumatic System

TS 8.4.1 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 2 psi as indicated on the instrument panel mounted air gauges, within 60 minutes from the point of governor cut-off. All production buses, prior to presentation shall be tested using a certified digital gauge from a dedicated auxiliary port tap point located at an interior front panel space. The port shall be equipped with a suitable quick disconnect device. No bus may be presented without air test passed document.

Provision shall be made to apply shop air to the bus air systems using a quick disconnect fitting specified in Attachment to Section 6: Technical Specifications, and shall be easily accessible and located in the engine compartment and near the front bumper area for towing. Air fittings for front towing shall be pointed forward in the same plane as the vehicle floor. Air for the compressor shall be filtered through the main engine air cleaner system. The air system shall be protected by a pressure relief. It shall be equipped with check valve and pressure protection valves to ensure partial operation in case of line failures. The vehicle air system shall contain a Ping Tank or Muffler tank equipped with a drain.

TS 8.4.2 Air Compressor
The electrically-driven, direct drive coupled, oil-less air compressor shall be sized to charge the air system from 40 psi to the governor cutoff pressure in less than 3 minutes. The air compressor shall incorporate the aftercooler as part of the basic unit.

The air compressor capacity shall be the highest capacity available for the engine application in each model year/production run for the duration of the Contract. All air reservoirs shall meet the requirements of SAE standard J10 and shall be equipped with drain plugs. The reservoir shall be sloped toward the drain plug. The Contractor shall supply system performance test data coincident to the PILOT INSPECTION.

The after-cooler shall not be located in any passenger area or ducting. Required: the aftercooler shall be a forced air cooled appliance if part of a motor/compressor module as defined herein. The cooler piping shall be finned and the total number of turn in degree of circle shall not exceed 150°. The air compressor after-cooler shall be designed to lower and maintain the outlet air temperature of the compressor to a level that properly supports air-dryer performance during all operating cycles and ambient conditions. The after-cooler shall not be arranged with any fitting(s) that cause inertial separation or consequential velocity loss as to impede or trap particulates or lower particulate velocity to a point of settlement within the after-cooler. The after-cooler shall be removable as an assembly or coupled assembly, the unit shall consist of its heat reject element(s) and necessary support structure and it shall be constructed in a manner and form of that of a distinct fully engineered assembly.

TS 8.4.2.1 Electrically Driven Air Compressor Module
An electric direct drive motor air compressor system shall be provided. The compressor shall be an oil-less type. The motor, compressor and controls shall be located and fixed to a removable plate of a construction that defines a modular system so as to permit the principal operating system units to be removed and installed as a unit. The controls are necessary governance, pressure regulation and electric switching (contactor). As follows:
a.) Compressor mounting plate does not require nor prohibit removal of devices. Compressor, motor and controls may be removed as units or module in whole without removal of other surrounding devices or units.

b.) Electrical and pneumatic coupling(s) shall be arranged at the module plate. If roof mounted, lifting provisions shall be provided, if side or compartment mounted, a draw out or removal means shall be provided. The unit may be under-hung and drawn down for required modular replacement. An under pan may be provided for splash and pollution control.

c.) Contactor-an HVIL shall be provided. The contactor shall be mounted in an enclosure suitable to water spray and pressure wash. The contactor shall indicate line side power if present when inverter supplies said condition. If, where the contactor is remotely mounted from the motor a means of line voltage indication shall be arranged for at the compressor module.

d.) The drive motor shall operate from the contractor supplied 3 phase medium voltage inverter. In addition to the contactor there shall be a manual disconnect means with a lock out for safety.

e.) The drive motor shall be a commercially available, thermally protected inverter rated NEMA unit of a standard form. The motor shall employ sealed bearings and it shall not require routine maintenance. The motor shall be unaffected by water, salt spray or pressure washing.

f.) The compressor shall be arranged for full access where lubrication or other routine maintenance is required. Compressors that require grease lubrication shall be equipped with Zerk™ type fittings and said fittings shall be arranged and brought out to the base unit perimeter so that no shrouding of other removal of equipment is required for routine maintenance.

g.) Control and 3rd Party Reporting-Upon activation of the air compressor contactor the multiplex system shall record the time on compressor from the compressor contactor.

h.) Compressor check or back flow means shall be the best quality Bendix, all brass construction and compressor supplier/SEPTA approved type and it shall be arranged on the mounting plate and the valve shall not be directly mounted to the compressor or suspended from the compressor discharge line.

i.) Where transmission belts are required a swing or lift out belt cover shall be arranged.

j.) Where belt transmission is arranged the tensioning system shall incorporate full length rail cross heads and guides and the tensioning lead screw shall provide positive tension and slack control and positive locking means.

TS 8.4.3 Air Lines and Fittings

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE Standard J844 for nylon tubing if not subject to temperatures over 200 degrees F. Parker Prestomatic Nylon tubing and associated fittings 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, except fuel lines.
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-foot intervals in under floor applications. Nylon lines may be grouped and shall be clamped to the vertical support structure at intervals not to exceed 60 inches. Nylon lines may be grouped and shall be supported at 2-foot intervals or less. The installation of airlines and fittings shall be inspected and evaluated on the Pilot Bus.

The compressor discharge line between power plant and body-mounted equipment shall be flexible convoluted copper or stainless steel line, or may be flexible Teflon hose with a braided stainless steel jacket. End fittings shall be standard SAE or JIC brass or steel, flanged, swivel type fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2-foot intervals or less.

Air lines shall be clean before installation and shall be installed to minimize air leaks. All air lines shall be sloped toward a reservoir, where practical, and routed to prevent water traps. Grommets or insulated clamps shall protect the air lines at all points where they pass through understructure components. The installation will be verified on the Pilot Bus inspection.

**TS 8.4.4 Air Reservoirs**

All air reservoirs shall meet the requirements of FMVSS Standard 121 and SAE Standard J10 and shall be equipped with guarded or flush type drain valves. Major structural members shall protect these valves and any automatic moisture ejector valves from road hazards if mounted at or below floor level. Reservoirs shall be sloped toward the drain valve. All air reservoirs shall have brass drain valves which discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

The Contractor shall provide three J1939 CAN connected air transducers as flows:

i) Transducer ported to the primary air supply tank
ii) Transducer ported to the secondary air supply tank
iii) Transducer ported to the auxiliary air supply tank

The transducer shall provide message formats as defined and specified by the IVS system contractor.

**TS 8.4.5 Air System Dryer**

An air dryer shall prevent accumulation of moisture and oil in the air system. The air dryer system shall include a replaceable desiccant bed, electrically heated drain, and activation device. A 2M/3M mechanic shall replace the desiccant in less than 15 minutes.

**TS 8.4.5.1 Air Dryer**

A Graham-White QBA 15 NX5 desiccant type air dryer shall be installed on the vehicle between the compressor and the wet supply tank reservoir. The dryer shall be equipped with a "quick-change" type cartridge which does not require complete dryer removal. The preceding requirement regarding dryer non-removal may be waived if the Contractor can supply a dryer system that extends the desiccant service life to thirty six (36) months minimum. The air dryer shall include an unloader/purge valve and built-in muffler for quiet unload operation. The air dryer shall have a thermostatically controlled, automatically heated unloader/discharge port. The dryer shall be a multi-desiccant type.

The dryer shall contain either an integral or discreet inlet oil, hot gas discharge coalescent filtration system rated to 0.03 µm absolute for water and gases and 0.3 µm for carbon and dirt particulates.

The dryer shall maintain a dew point depression of 70°F minimum.
The dryer shall load and regenerate irrespective of compressor operation or duty cycle.

The dryer shall have a continuous outflow rating of 25 scfm minimum.

A 2M/3M mechanic shall replace the desiccant in less than 15 minutes. The air dryer shall include an unloader/purge valve and built-in muffler for quiet unloading operation. The air dryer shall have a thermostatically controlled, automatically heated safety relief valve set at 150 PSI.

A compressor water separator shall be installed into the air supply line between the compressor and air dryer. The oil separator shall be electrically heated to prevent clogging and activated by the brake circuit to discharge contaminates prior to the desiccant dryer.

The compressor oil separator appended valve shall function upon service brake application and in if engine on run state is obtained and no service brake application obtained it shall alternate to a program that directs in any one minute period by timing at 3 times per minute 17 seconds on (coil picked up) and 3 second off.

An automatic and heated moisture ejector valve shall be installed in air the tank immediately forward of the wet tank.

**TS 8.5 Reserved**

**TS 9. Body**

**TS 9.1 General**

**TS 9.1.1 Design**

The bus shall have a clean, smooth, simple design, primarily derived from bus performance requirements and passenger service criteria established by Section 6: Technical Specifications. The exterior and body features, including grilles and louvers, shall be shaped to allow complete and easy 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 interior of 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 on any window of the bus of spray and splash generated by the bus' wheels on a wet road shall be minimized.

**TS 9.1.2 Crashworthiness**

The bus body and roof structure shall withstand a static load equal to 150 percent of the curb weight evenly distributed on the roof with no more than a 6-inch reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. These requirements must be met without components such as roof mounted air conditioning installed.
The bus shall withstand a 25-mph impact by a 4,000-pound automobile at any point, excluding doorways, along either side of the bus with no more than 3 inches of permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the bus interior.

Exterior panels below 35 inches from ground level shall withstand a static load of 2,000 pounds applied perpendicular to the bus by a pad no larger than 5 inches square. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the bus.

Proposer shall provide a letter, signed by an officer of the company, certifying that the coach offered complies with all applicable FMVSS requirements, and is capable of meeting the Crash Worthiness requirements as noted in this section of the specifications.

An actual coach, of the basic design offered, shall have been tested by a qualified independent third party testing organization for the Proposer to show compliance of its coach with the static roof load, side impact, and skirt deformation requirements of this section. A copy of the test certification(s) supported by fully documented test report(s) must be provided by the Contractor within five (5) days of SEPTA’s written request. The test report(s) must include a detailed description of the test procedures used and all data obtained during the test, and must be in English.

**TS 9.1.3 Materials**

Unless otherwise specifically provided, all equipment, and articles incorporated in the work are to be new and of the most suitable grade for the purpose intended. Body materials shall be selected and the body fabricated to reduce maintenance, extended durability and provide consistency of appearance throughout the life of the bus. The Contractor shall be required to obtain a certification from the manufacturer of the coatings applied to the steel frame tubes which states that the surface preparation and coating application methods are of the highest quality and will ensure the optimum level of corrosion prevention or the protection to passivation layer as it applies to stainless steel. This certification shall be signed and notarized by an Executive Officer of the coating manufacturing firm. If the bus body is manufactured outside of North American Continent, protective coating shall be applied to prevent corrosion damage during shipment. Detailing shall be kept simple; add on devices and trim shall be minimized and where necessary, integrated into the basic design.

The body material surfaces shall be protected against graffiti and vandalism. The specific requirements for the treatment of exterior surfaces are defined in Section TS 9.3 and interior surfaces in Section TS 9.4.

**TS 9.1.4 Corrosion**

The bus shall resist corrosion from all sources that may be found in the Philadelphia Metropolitan area over its 15 (chassis) year service life. All tubes treated with inner rust inhibitor shall be plugged/sealed sufficiently to prevent leakage of rust inhibitor due to excessive heating. The bus shall maintain structural integrity and nearly maintain original appearance throughout its service life, provided it is maintained by SEPTA in accordance with reasonable maintenance procedures, i.e., a minimum of 300,000 mile intervals with no requirement for comprehensive re-coating of the structure, as may be specified in the manufacturer’s service manual. The aforementioned specified maintenance practices and shall be agreed upon by the Contractor and SEPTA coincident to the PILOT INSPECTION.

The bus shall be designed with corrosion prevention in mind. Designing a product so that water and contaminants are kept out of and away from it and that damage does not occur to protective coatings is a reasonable first step. The next step requires the use of corrosion resistant materials. Unprotected carbon steel sheets may not be used on the underside of the bus, nor may they be used for the side skins and/or roof of the bus. Carbon steel does not
become acceptable using paints or topical coatings. Every attempt must be made to use materials that resist corrosion, require a minimum of maintenance to maintain corrosion resistance, and take advantage of the latest technologies to resist corrosion.

If tubular copper bearing steel is used to fabricate the structure of the bus, the inner surfaces of all the tubes must be treated with a rust inhibitor, Tectyl 506, Waxol or equal. The interior tube rust inhibitor requirement shall be waived for the roof if it can be proven to be structurally detrimental to the vehicle as a result of damage caused by the application. This waiver shall not compromise the corrosion warranty requirements of this specification. The exterior of all frame members shall be prepared and primed with a process that includes, at minimum, solvent cleansing to remove all oil, grease and dirt, grit blasting or equivalent chemical process to produce a surface profile which maximizes primer adhesion, and priming with a uniform thickness of zinc rich primer. All exposed surfaces of the undercarriage shall be undercoated with Tectyl 127 CG or equal. The requirements of this section are in addition to the requirements of Section TS 9.1.7. Materials exposed to the joints and connections of dissimilar metals shall be protected from galvanic corrosion. Representative samples shall withstand a minimum of two (2) week salt spray test in accordance with ASTM Procedure B-117 as revised, with no visual or structural detrimental effects to normally visible surfaces and no significant structural degradation or weight loss of over one (1) percent for other members or components.

**TS 9.1.5 Resonance and Vibration**
All structure, body, and panel-bending mode frequencies, including vertical, lateral, and torsional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible, or sensible resonant vibrations during normal service.

**TS 9.1.6 Fire Protection**
The passenger and engine compartments shall be separated by a bulkhead(s) which shall, by the incorporation of steel or other approved material in its construction, be a firewall. No firewall shall utilize wood or composite materials in its construction or application. As is the case of all firewalls, there shall be no openings in the material that will allow the introduction of flames from one side of the firewall to the other. This firewall shall retard propagation of an engine compartment fire into the passenger compartment. The manufacturer shall provide the fire rating time for their proposed necessary openings. Piping through the bulkhead shall have copper, brass or metallic fireproof fittings sealed at the firewall with copper or steel piping on the forward side. Wiring harness may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the firewall. The conduit and bulkhead connectors shall be sealed with fireproof material at the firewall. The engine access panels in the firewall shall be fabricated of fireproof material and secured with fireproof fasteners. These panels, their fasteners and the firewall shall be constructed and reinforced to minimize warping of the panels during a fire that may compromise the integrity of the firewall. If the floor or any other part of the bus is incorporated in the design to act as a firewall, the same shall meet all requirements of this section. Where bulk head fittings and through lines are of a pitch (distance of centers or nut perimeter) as to prevent lateral approach and use of standard tools the Contractor shall furnish line type socket wrenches designed to manipulate the affected fastenings.

**TS 9.1.7 Distortion**
The bus, at GVWR and under static conditions, shall not exhibit deformation or deflection that impairs operation of doors, windows or other mechanical elements. Static conditions include the vehicle being at rest with any one wheel or dual set of wheels in a six (6)-inch-deep hole. Each bus chassis shall have a body alignment check performed on it to ensure that its axle housing and axle frame (when so designed) are properly centered and aligned to the chassis frame center and each other, also to prevent the vehicle from "dog tracking". This check shall include
either a diagonal measurement across the bus undercarriage or six (6) control points on the axles or axle hubs; a double triangulation of the front and rear axle hubs, and a linear measurement of the wheel base on both sides of the vehicle, or another mutually agreeable and verifiable squaring method.

**TS 9.2 Structure**

**TS 9.2.1 General**

**TS 9.2.1.1 Design**
The structure of the bus as defined in Section TS 9.1, shall be designed to withstand the transit service conditions typical of an urban duty cycle. The Design Operating Profile defined in Section TS 2 shall be considered for this purpose. Structural elements, chassis and major subassemblies shall be an appropriate grade of steel or stainless steel.

**TS 9.2.1.2 Altoona Testing**
Prior to acceptance of first bus, the structure of the bus shall have undergone appropriate structural testing and/or analysis, including FTA required Altoona testing, to ensure adequacy of design for the urban transit service. Any items that required repeated repairs or replacement must undergo the corrective action with supporting test and analysis. A report clearly describing and explaining the failures and corrective actions taken to ensure any and all such failures will not occur shall be submitted to SEPTA.

**TS 9.2.2 Towing**
Towing devices shall be provided on each end of the bus. The front towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20° of the longitudinal axis of the bus. The rear towing device shall be utilized for recovery or flat towing and shall withstand the associated loads without deformation or damage to the vehicle structure. The rear towing device(s) shall not provide a toehold for unauthorized riders. The front towing devices shall withstand attachment of a rigid tow bar and shall permit lifting of the bus at curb weight by the towing devices and the tow bar until the front wheels are clear of the ground. The rear towing device shall be utilized for recovery or flat towing and shall withstand the associated loads without deformation or damage to vehicle structure.

The method of attaching the tow bar shall require specific approval of SEPTA. Each towing device shall accommodate a crane hook with a one-inch throat. The towing procedure shall not require removal of any access doors. Front tow eyes shall be located behind the front bumper in a SEPTA approved location. The vehicle manufacturer shall also provide SEPTA with towing and/or lift bar/devices necessary to recover/tow the bus. The towing system shall be designed with "quick disconnect" air lines and electrical attachments/couplings mounted in the front end, easily accessible for mating with the front and rear couplings on the recovery vehicle (usually a wrecker). The towing system shall allow for the activation of the bus brake lights by the recovery vehicle operator from his/her vehicle during recovery/towing operations. The towing system shall also be designed so as to not interfere with other bus components. The stop, tail, and turn signal system shall be powered by the wrecker lighting system. Further, the trailer plug and quick disconnect shall be arranged as to limit the possibility of damage from road salt and contamination, and physical damage. The performance of the towing system shall be verified at the
PILOT INSPECTION, (Contractor shall supply one (1) tow-bar coincident with Pilot Bus delivery). Quantity of
tow bars/adapters is identified in Attachment to Section 6: Technical Specification.

**TS 9.2.3 Jacking**
It shall be possible to safely jack up the bus, at curb weight, with a common 10-ton floor jack with or without
special adapter, when a tire or dual set is completely flat and the bus is on a level, hard surface, without crawling
under any portion of the bus. Jacking from a single point shall permit raising the bus sufficiently high to remove
and reinstall a wheel and tire assembly. Jacking pads shall be conspicuously identified, located on the axle or
suspension, body/chassis near the wheels and shall permit easy and safe jacking with the flat tire or dual set on a 6-
inch-high run-up block not wider than a single tire. Jacking and changing any one tire shall be completed by a 2M
mechanic helper in less than 30 minutes from the time the bus is approached. The bus shall withstand such jacking
at any one or any combination of wheel locations without permanent deformation or damage.

**TS 9.2.4 Hoisting**
The bus axles or jacking plates shall accommodate the lifting pads of a 3-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. Hoist adapters shall be provided to interface between the
bus and SEPTA 3-post lifts. Quantity of hoist adapters is identified in attachment to Section 6: Technical
Specifications.

**TS 9.2.5 Floor**

**TS 9.2.5.1 Design**
The floor shall be essentially a continuous flat plane, except at the wheel housings and platforms. The floor height
shall be as specified in Section TS 6.7, to eliminate steps and facilitate boarding and de-boarding of passengers.

Height of the floor above the street shall be no more than 15.5 ± 0.2 inches, measured at the centerline of the front
door. The floor may be inclined only along the longitudinal axis of the bus. The incline shall be 4.8° or less behind
the rear door. All floor measurements shall be taken with the bus on a level surface and at normal ride height.
Manufacturers proposing sharp or abrupt floor changes must demonstrate to SEPTA’s satisfaction that said inclines
or steps will not be a safety hazard for SEPTA Ridership.

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 1 ¾ inch. Similarly, a molding or cove 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 20 to allow for drainage.

**TS 9.2.5.2 Strength**
The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or
horizontal movement 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. The use of adhesives to secure the floor to the structure
shall be allowed only in combination with the use of bolt or screw fasteners and its effectiveness shall last
throughout 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 inches from the normal plane. The floor shall withstand the application of 2.5 times gross load weight without permanent detrimental deformation. Floor, with coverings applied, shall withstand a static load of at least 150 pounds applied through the flat end of a ½ inch-diameter rod, with 1/32-inch radius, without permanent visible deformation.

**TS 9.2.5.3  Construction**

The floor shall consist of the subfloor and the floor covering (See TS 9.4.5 Floor Covering). 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.

If plywood is used, it 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 0.75” nominal thickness, 7 ply ACX grade and be of a grade that is manufactured with a solid face and back. Plywood shall be installed with the highest-grade veneer up. Plywood shall be pressure-treated with a preservative chemical that prevents decay and damage by insects. Preservative treatments shall utilize no EPA listed hazardous chemicals. The concentration of preservative chemical 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 moisture content at or below fifteen percent. A barrier shall be installed to prevent contact by road salt with the plywood panels.

In order to save weight sub-floor may consist of a combination of composite and plywood flooring. Composite flooring shall at a minimum possess equivalent structure and flammability properties to the above specified plywood.

Fasteners shall be compatible with the sub-flooring. Fasteners shall not corrode or react with the chemicals used to pressure treat the sub-flooring.

**TS 9.2.6  Platforms**

**TS 9.2.6.1  General**

Platform height shall not exceed 16 inches. Trim shall be provided along top edges of platforms unless integral nosing is provided. Except where otherwise indicated, covering of platform surfaces and risers shall be same material as specified for floor covering.

Other raised areas such as for providing space for underfloor installation of components shall be limited. Such raised areas shall be constructed in accordance to these specifications.

**TS 9.2.6.2  Operator’s Platform**

The operator's platform shall be of a height to render the position of the operator with respect to the road surface the same as on standard floor buses. If the height of the operator's platform exceeds 13.5 inches, a step shall be provided to allow for ease in boarding. A warning decal or sign shall be provided to alert operator to the change in floor level regardless of platform height.

**TS 9.2.6.3  Farebox**
If the driver’s platform is higher than 12 inches, then the farebox is to be mounted on a stainless steel, platform of suitable height to provide accessibility ranging from a five percentile female to a 95 percentile male without compromising neither passenger access nor access to the farebox for fare extraction process. The farebox platform shall be arranged to properly/rigidly support the farebox dead weight while ensuring that the foundational mountings preclude differential vibration of the box. The farebox platform shall be structurally a continuation of the local framing elements. A 304 L stainless steel farebox mounting plate and stainless steel quick release hardware shall be provided along with an appropriate farebox power cable. A complete description, drawings and part numbers are in attachment to Section 6 (TS 11.26); Technical Specifications. The farebox arrangement shall support new fare payment devices attached to existing farebox equipment. The new fare payment devices wiring shall be fully integrated to the vehicle. All attendant harnesses and like equipment shall be protected from intended or unintended abuse or damage by use of flexible amour shielding and bulkhead connectors and fittings.

**TS 9.2.6.4 Intermediate Platform**

If vehicle is of a bi-level floor design, an intermediate platform shall be provided along the center aisle of the bus to facilitate passenger traffic between the upper and lower floor levels. This intermediate platform shall be cut into the rear platform and shall be approximately the aisle width, 15.5 inches deep and approximately one half the height of the upper level relative to the lower level. The horizontal surface of this platform shall be covered with a material matching the floor covering. It shall be sloped slightly for drainage. Intermediate platforms shall be fitted with bright yellow step noising. A warning decal or sign shall be provided at the immediate platform area to alert passengers to the change in floor level.

**TS 9.2.7 Wheel Housing**

**TS 9.2.7.1 Design**

Sufficient clearance and air circulation shall be provided around the tires, wheels, and brakes to preclude overheating when the bus is operating on the design operating profile. See Section TS 2. The Contractor shall submit a Certified Report due at the Pilot Inspection. 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 requirements of Section TS 5.21, Noise.

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

The exterior finish of the front wheel housings shall be scratch-resistant, meeting requirements of Section TS 9.4.1, Interior Panels and Finishes, and complement interior finishes of the bus to minimize the visual impact of the wheel housing. If fiberglass wheel housings are provided, then they shall be color-impregnated to match interior finishes. The lower portion extending to approximately 12 inches above floor shall be equipped with additional mar-resistant stainless steel kick panels.

**TS 9.2.7.2 Construction**

Wheel housings shall be constructed of corrosion-resistant, fire-resistant material. Wheel housings, as installed and trimmed, shall withstand impacts of a 2-inch steel ball with at least 200 foot-pounds of energy without penetration.
TS 9.3 Exterior Panels and Finishes

TS 9.3.1 Pedestrian Safety
Exterior protrusions greater than one inch and within 80 inches of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors and required lights and reflectors are exempt from the protrusion requirement. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize the ability of unauthorized riders to secure toeholds or handholds.

TS 9.3.2 Roofline Fairing
Roofline fairing shall be arranged to minimize the accumulation and trapping of debris and/or other sundry material or items that can in operation cause said accumulated debris or material to be released from the vehicle. The fairing shall be gapped or otherwise arranged to permit lateral, or equal, escape of water and fugitive vegetation, e.g., leaves etc, and shall not chafe roof panels. The roof line fairing shall be painted the vehicle color. All fairing panels, mountings, hardware and brackets shall be painted the same color on all surfaces, including the inboard facing surfaces.

Roofline fairing shall not cover, occlude or in any way inhibit the inspectability of equipment. Roofline fairing shall not be an integral part of a walkway or personnel pathway. The fairing shall be arranged as to preclude standing, walking or functioning as a toe or hand hold.

Accumulated material shall not cause functional diminishment of roof mounted equipment or in anyway be a factor in direct or consequential damage to said roof mounted equipment. All roofline fairing shall be arranged upon brackets extending from basic structural components attached by fixing screws or studs. All such brackets or frame extensions shall be arranged with permanent UV resistant gasketing, no SikaFlex shall protrude from gasketed areas. Said mounting brackets shall be designed to last the life of the vehicle and shall be painted the same color as the vehicle. All panels shall be individually removable, there shall be no adhesives connecting one panel to another. All additional required brackets and members shall be retained with redundant multipoint fixing screws.

All panels shall be equipped with redundant safety wire or an equivalent means to ensure that the loss fixing screws do not cause the total release of fairing upon failure to primary system fasteners. All fixing screws and/or fasteners shall be either captive or arranged to preclude loss of fixed attachment.

Alternate integrated designs for concealing rooftop equipment such as clamshell covers shall be considered equivalent provided the enclosure system meet all other applicable section of this specification.

TS 9.3.3 Rain Gutters
Individual rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors, operator’s side window, and exterior mirrors. When the bus is decelerated, the gutters shall not drain onto the windshield, or operator's side window, or into the door boarding area. Cross sections of the gutters shall be adequate for proper operation.

TS 9.3.4 License Plate Provisions
Provisions shall be made to mount standard size U.S. license plates per SAE J686 on the rear of the bus. These provisions shall direct mount or recess the license plates so that they can be cleaned by automatic bus washing equipment without being caught by the brushes. License plates shall be mounted at the lower center or lower street side of the bus and shall not allow a toehold or handhold for unauthorized riders. An LED license plate lamp shall
be provided. License plate shall be fixed using stainless steel mounting hardware to permanent nut inserts, as part of the basic door structure.

**TS 9.3.5 Reserved**

**TS 9.3.6 Fender Skirts**

Features to minimize water spray from the bus in wet conditions shall be included in wheel housing design. All fender skirts shall be unbreakable and 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. Fender skirts shall be flanged and fixing screws shall be accessible from the exterior vertical plane.

**TS 9.3.7 Pedestrian Safety**

Splash aprons, composed of 1/4-inch-minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and protect underfloor components. The splash aprons shall extend downward to within 6 inches of the road surface at static conditions. Apron widths shall be no less than tire widths, except for the front apron that shall extend across the width of the bus. 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. Other splash aprons shall be installed where necessary to protect bus equipment.

**TS 9.3.8 Service Compartments and Access Doors - Exterior**

**TS 9.3.8.1 Access Doors**

Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments including a door for checking the quantity and adding to the engine coolant. The main engine door shall be used to check and fill engine lubricant and propulsion system fluid. Access openings shall be sized for easy performance of tasks within the compartment including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus washing operations. Doors with top hinges shall have safety props stored behind the door or on the doorframe. All access doors larger than six square feet size shall be retained in the open and closed position by gas-filled springs and shall be easily operable by one person. Doors smaller than six (6) square feet size may be retained in the open position with props or gas springs. 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. Roof mounted access handles are not required to meet the flush mount requirements. Access doors, when opened, shall not restrict access for servicing other components or systems. In no case shall any door be removable from the vehicle as a part of normal service maintenance. If applicable, an exterior, driver’s heater/defroster access door may be hinged from the bottom. The access door shall be retained in the open position with cables or by other means to preclude contact/damage from the bumper or bicycle rack.

Access doors shall be equipped with corrosion resistant flush-mounted or spring type locks where approved by SEPTA. All such access door locks that require a tool to open shall be standardized throughout the vehicle and will require a nominal 5/16-inch square male tool to open or lock. Access doors for the fuel filler, DEF filler, battery switch and coolant filler are exempt from the above requirements.
TS 9.3.8.2 Battery Compartment-Standard Type
The battery compartment shall be vented and self-draining. It shall be made from 304 stainless steel, accessible only from outside the bus. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from 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. Any covers that may be utilized to protect the batteries shall be electrically non-conductive. The batteries shall be secured by a restraint means. A locking slide-out or swing out tray constructed of 304/316 stainless steel or heavy duty 3/16” polyethylene shall be provided for the servicing of the batteries. The tray shall permit the batteries to fully clear the bus side panel, allowing maintenance personnel full access to the tops of the batteries. All power cabling which passes through the compartment walls shall have "feed through studs" or properly bushed holes.

A single piece battery hold downs shall be made of non-conductive material, Delrin, Micarta, Glastic or equal that shall hold the batteries in place and due to its material properties and mechanical arrangements shall be inherently non-conductive and shall prevent battery cable shorting. The hold-down shall be arranged with saddle clamps, cast or bonded, that shall secure top mounted cabling and by layout and material said cabling shall not cross or chafe. Hold down securement shall be arranged at the perimeter of the battery hold –down structure. The hold-down securement shall be plain rod with holes arranged to support pull clip, pins or equal type release devices.

The Master Battery Switch shall be accessible from the outside of the bus. Access shall be gained through a spring loaded, non-latching door. The access door shall be clearly identified from the outside of the bus as the Battery Shut-Off.

TS 9.3.8.3 Service Area LED Lighting
Lights shall be provided in the engine and all other compartments to generally illuminate the area for night emergency repairs or adjustments. All lamps shall be LED. Lamp assemblies shall be provided in the engine compartment and shall be controlled by a switch located near the rear start controls in the engine compartment. Necessary lights, located in other service compartments, shall be provided with switches on the light fixture or convenient to the light. All light switches shall have on/off decals. Lighting shall be waterproof and sealed to prevent the entrance of dirt, debris and moisture from pressure washing. All service lighting shall be 30 lux (candelas) minimum in all areas where equipment is placed.

TS 9.3.9 Bumpers

TS 9.3.9.1 Location
Bumpers shall be of the energy absorption-type and shall provide impact protection for the front and rear of the bus up to at least 20 to 25 inches above the ground under normal ride height. The bumper shall wrap around the bus to the extent practical without exceeding allowable bus width, or compromising accessibility to equipment. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

TS 9.3.9.2 Front Bumper
No part of the bus, including the bumper, shall be damaged as a result of a five (5) mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the longitudinal center line of the bus. The bumper shall protect the bus from damage as a result of 6.5 mph impacts parallel to the longitudinal centerline of the bus and 5.5 mph impacts perpendicular to the longitudinal centerline of the bus.
impacts into the corners at a 30° angle to the longitudinal centerline to the bus. The energy absorption system of the
bumper 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 Contractor shall install a Sportworks stainless steel, narrow profile bicycle rack on the front of each bus. The
rack shall accommodate two bicycles.

**TS 9.3.9.3 Rear Bumper**
The rear bumper and its mounting shall provide impact protection to the bus at curb weight from two (2) mph
impact with a fixed flat barrier perpendicular to the longitudinal centerline of the bus. The rear bumper shall protect
the bus when impacted anywhere along its width by the striker loaded to 4,000 pounds, at 4-mph parallel to, or up to
a 30 degree angle to, the longitudinal centerline of the bus.

**TS 9.3.9.4 Bumper Material**
Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without
sustaining damage. Visible surfaces shall be black or color-coordinated with the bus exterior. The coloring of this
shall be impregnated in the bumper material, painted bumper surfaces are not acceptable. The bumper qualities
shall be sustained throughout the service life of the bus.

**TS 9.3.9.5 Certification**
The Contractor shall indicate that the bumpers have a satisfactory record of transit use, and shall furnish data of
certified tests conducted by an independent laboratory that will simulate normal in-service condition of the vehicle.
The certification due 5 days prior to pilot bus delivery.

**TS 9.3.10 Finish and Color**
All exterior surfaces shall be painted the color specified herein. Paint quality applies equally to all painted exterior
and interior surfaces.
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 to prevent corrosion. The bus
shall be completely painted prior to installation of exterior lights, windows, mirrors and other items that are applied
to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or
improperly fitted panels.

Paint shall be applied smoothly and evenly with the finished surface free of dirt and the following other
imperfections:
1. Blisters or bubbles appearing in the topcoat film.
2. Chips, scratches, or gouges of the surface finish.
3. Cracks in the paint film.
4. Craters where paint failed to cover due to surface contamination (fish eye).
5. Overspray.
6. Peeling
7. Runs or sags from excessive flow and failure to adhere uniformly to the surface.
8. Chemical stains and water spots.
9. Orange Peel.
All exterior finished surfaces shall be impervious to diesel fuel, gasoline and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals. Colors and paint schemes shall be in accordance with the Attachment TS 11.10: Technical Specifications.

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 except as specified in Attachment Section TS 11.10: Technical Specifications. Durable, peel-resistant pressure sensitive appliqués shall be used for any striping and coloring required.

The color scheme shall be resolved during the pre-proposal Q&A meeting.

**TS 9.3.11 Numbering and Signing**

Monograms, numbers and other special signing specified by SEPTA shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade-, chip, and peel-resistant; they may be painted signs, decals, or pressure-sensitive appliqués. All decals shall be sealed with clear, waterproof sealant around all exposed edges if required by the decal supplier. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part, Subpart B, 38.27. The exact wording, size, color, and locations for these signs are found with requirements for other special signs in Attachment to Section TS 11.11, TS 11.15 and TS 11.23: Technical Specifications.

**TS 9.3.12 Exterior Lighting and Headlamps**

All lighting as defined herein, shall be LED 12 volt nominal DC powered, warranted for twelve (12) years upon vehicle acceptance. Headlamps shall be Dailight™ LED type. The headlamp system shall be replaceable unit type permitting separate lamp elements to be maintained in a reusable housings.

Upon simultaneous application of both turn signal switches, bus set to run position, parking brake applied, all exterior lamps shall illuminate, and flash if required. Said condition shall remain until time out at 90 seconds or cancellation by application of park brake or master switch set to OFF.

All exterior lights shall be sealed "LED" type lamp to prevent entry and accumulation of moisture, water or dust and each lamp shall be easily replaceable and shall meet current applicable ADA, FMVSS 108 and SAE J592. All non-FMVSS 108 lights shall be LED type, i.e., side turn signals, collision avoidance lamp(s) amber kneeling light, front and center door overhead lights etc. All LED lighting shall be the best obtainable and may require the approval of SEPTA engineering. Lights mounted on the engine compartment door shall be protected from the impact shock of door opening and closing, engine heat and detergents used by automatic bus washing equipment. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Lamps at the rear of the bus shall be clearly visible from behind when service doors are opened. Said lighting and its placement shall require SEPTA approval, at the PILOT INSPECTION. All exterior lamps shall have a minimum of 6 inches of wiring harness slack behind the lamp to permit access to local connectors for quick change-out.

A center rear LED brake light shall be provided in addition to the standard left and right side brake lights.

Visible and audible warning shall inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE standard J593 as revised. Audible reverse operation warning shall conform to SAE Recommended Practice J994, Type C or D as revised.

Lamps at all doors shall activate only when the doors open and shall have an illumination at the street surface level of no less than two (2) foot-candles for a distance of three (3) feet outward from the door step edge. Lamps defined by this section shall be located at the upper door lintel area and shall be strip type lamps two (2) per door location. This light shall be lit when the door is opened and master switch on. They shall be extinguished when the door is
closed. All door lighting shall meet ADA requirements and they shall be located inside at the upper portal area. If multi-stage ramps require extension lighting, lighting shall meet the aforementioned requirements along with the following:
LED lamps on ramp extensions must be affixed with non-corroding hardware, lamps must be replaceable in 5 minutes or less with no special tools.

Turn-signal lights shall be provided on both sides of the bus. Specific number and mounting requirements are defined in Attachment to Section TS 11.17: Technical Specifications.

A license plate bracket and LED light shall be provided at the rear of the bus. The location of the license plate bracket and light assembly shall be approved by SEPTA at the PILOT INSPECTION.

Flashing directional signals with controls mounted on the floor in the operator's compartment shall be provided. Turn signal lights shall be provided on both sides of the vehicles as well as on the front and rear of the bus with self-canceling or foot control switch(es) and an "override" or emergency flasher switch to permit continuous "4-Way" of all directional lights for emergency parking. The turn signals shall not be canceled by service brake application. The back-up and stop lights shall be installed on the rear of the bus. If turn signal system is not an incorporated feature of an integrated vehicle electronic system, then the flasher system shall be totally electronic.

The clearance and identification "LED" lights and reflectors shall be installed in accordance with FMVSS108 and this Technical Specification.

Identification Lights: Cluster of three (3) 4-candle power, "LED" clearance lights shall be mounted near the top of the roof and on the body center line, one on the front of the bus with amber lenses and one on the rear of the bus with red lenses.

Clearance Lights: Four (4) 4-candle power "LED" 12 VDC marker lights shall be installed, on each upper corner and side of the body. The four (4) front fixtures shall have amber-colored lenses and the four (4) rear fixtures shall have red-colored lenses.

Two (2) 4-candle power 12 VDC intermediate marker lights, one (1) on each side of the bus, shall be installed at approximately the center of the bus. The lights shall be amber-colored.

The bus shall be equipped with LED head lights which shall have mechanical horizontal and vertical adjustments. Day light running lights shall be provided that operate the head lamps at reduced duty cycle when operating during the day. The feature shall be automatically controlled at the Master Switch and shall be incorporated with the vehicle electrical multiplex if so equipped. The day time running lights shall illuminate upon release of the park brake valve. The performance characteristics of the system shall be accomplished as defined by applicable portions of the SAE J2087 practice.

The bus shall be equipped with a waterproof, non-rotating, strobe type "Help Light" on the roof area above the operator's head. The help light(s) on vehicles equipped with roof fairing shall be multiple high output LED type lighting. Specific model number defined in Attachment to Section TS 11.25: Technical Specification.

The light shall be wired to a special switch installed in a position easily accessible to the operator's left hand. The “Help Light” switch shall be a momentary contact type and feature a protective cover to prevent inadvertent
activation. The light flashing function shall be an incorporated feature of the vehicle multiplex system. The location and mounting of light fixtures and switch shall be approved by SEPTA at PILOT INSPECTION.

**TS 9.4 Interior Panels and Finishes**

**TS 9.4.1 General**

Materials shall be selected on the basis of maintenance, durability, appearance, safety, flammability, and tactile qualities. Trim and attachment details shall be kept simple and unobtrusive. Materials shall be strong enough to resist everyday abuse and vandalism; they shall be resistant to scratches and markings. Interior components shall be resistant to gouging, chafing and other vandalism. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions. The joints (gap) between wall trim panels, wall panels, ceiling and flooring shall not be greater/wider than 1/32 inch.

Interior surfaces more than 10 inches below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the coach is parked on a level surface. Interior shall be easily cleanable with commercial cleaning agents. The entire interior shall be cleanable with a hose, using a liquid soap attachment. Water and soap should not normally be sprayed directly on the instrument and switch panels.

**TS 9.4.2 Front End**

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the operator's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing or walking in the front of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the operator's compartment shall be formed metal or plastic material and sealed to prevent liquid from entering through the top of panels into electrical compartments. Formed metal dash panels or approved equals shall be painted and finished to the quality described in Section TS 9.3.10. Plastic dash panels shall be reinforced, as necessary, vandal-resistant, and replaceable. The color of the interior front part of the bus ahead of the operator shall be painted (or color impregnated) non-reflective black. All colored, painted, and plated parts forward of the operator's barrier shall be finished with a dull matte surface to reduce glare. (See Section TS 9.6.1.1)

If and where modules, equipment and other items requiring maintenance attention are located in the front cap area they shall be inspectable and removable without removal of the fare box or stanchions/grab rails fixed to the interior front cap covering and housings.

Windshields wiper motor and transmission mountings shall be accessible from the exterior of the front cap by means of equipment door(s).

Wheel chock holders shall incorporate a skid panel (Teflon™ or Delrin™) that ensures that the holder surface is not damaged by the removal and insertion of the wheel chock. Wheel Chock Holder location shall be approved at the Pilot Inspection.

**TS 9.4.3 Rear End**

The rear bulkhead shall be carpet and trimmed with stainless steel or aluminum. Colors, patterns, and materials are defined in Attachment Section TS 11.21: Technical Specifications.

**TS 9.4.4 Interior Panels**

**TS 9.4.4.1 General**
Upper interior side trim panels shall be hard-faced melamine with a hardboard back from the bottom window line up to the junction of the side wall and the ceiling. Lower interior side trim panels shall be anodized, textured aluminum from the bottom of the window line to the lower seat track. It shall permit easy removal of paint, greasy fingerprints and ink from felt-tip pens. Panels shall be easily replaceable and tamper-resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Interior mullion trim, moldings and trim strips shall be stainless steel or aluminum. Individual trim panels and parts shall be interchangeable to the extent practicable. Untrimmed areas shall be painted and finished to the quality described in Section TS 9.3.10. All materials shall comply with the Recommended Fire Safety Practices defined in FMVSS 302. Colors, patterns, and materials for the interior trim are defined in Attachment Section TS 11.19: Technical Specification. All interior panel abutments, risers and joint ups shall be fully trimmed and finished-all trim shall be neatly and professionally installed and abutted with no gap to exceed 0.10”.

**TS 9.4.4.2 Operator Barrier**

An enclosure barrier panel, between the operator, the left front wheel well and or a passenger seat shall be provided. The barrier shall not be a wrap-around type. The aisle side stanchion shall have a handhold provision. The barrier shall eliminate glare and reflections in the windshield directly in front of the barrier from interior lighting during night operation. The enclosed panel shall extend from the floor to the ceiling, or wheelhousing in a low-floor design, and shall fit the bus side windows and wall to prevent passengers from reaching the operator or his/her personal effects. The Contractor shall provide the dimensional drawing detailing of operator’s enclosure space for SEPTA’s approval at the PILOT INSPECTION. This enclosure shall be ergonomically designed to accommodate the operator’s seat, fire extinguisher, operator’s personal items compartment, etc. The layout, mounting, barrier-material, operator’s personal compartment, coat hook, jacket strap used in the operator’s barrier shall be subjected to SEPTA’s approval at the PILOT INSPECTION. The close out panels may be required between forward stanchions and the driver’s barrier to protect the driver. Close out panel requirements shall be determined based on contractor’s layout drawing of driver’s area.

The operator’s storage compartment shall have a minimum wall thickness of 0.125 inches and shall be mounted on the operator’s side of the barrier and at a height accessible to an operator standing on the operator’s platform. The operator’s storage compartment shall be 2000 cu/in minimum, to accommodate a standard sized lunch box, purse and compact umbrella. The operator’s compartment door shall hinge at its top or side edge and incorporate a flush keyless latch.

**TS 9.4.4.3 Modesty Panels**

Sturdy, minimum 3 layer laminated divider panels constructed of durable, unpainted, corrosion-resistant material complementing the interior trim shall be provided to act as both a physical and visual barrier for seated passengers. The dividers shall be finished on both sides with a textured, leather grained, anodized aluminum finish as described in Attachment Section TS 11: Technical Specifications. The panels shall not drum and/or resonate with any operating mode. Modesty panels shall be located at doorways to protect passengers on adjacent seats, and along front edge of rear upper level. Design and installation of modesty panels located in front of forward facing seats shall include a handhold/grab handle along its top edge. These dividers shall be mounted on the sidewall and shall project toward the aisle no farther than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend no higher than the lower daylight opening of the side windows and those forward of transverse seats shall extend to within 3 inches + ¼ inch above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the doorways shall provide no less than a 2-1/2-inch clearance between the modesty panel and the opened door to protect passengers from being pinched. The dividers shall be extended by glazed sections (windscreens) to above the passenger door opening. Windscreens shall be 0.50” thick polycarbonate material. Modesty panels installed at doorways shall be equipped with grab rails (see Section TS 9.5.2). The modesty panel and its mounting shall withstand a dynamic
force of 500 pounds applied to a nine square (3² inch) area in the center of the panel without permanent visible deformation.

A windscreen shall be installed above the wheel-housing regardless of the modesty panel disposition.

**TS 9.4.4.4 Rear Bulkhead**
The rear bulkhead paneling shall be contoured to fit the ceiling, side walls, and seat backs so that any litter, such as a cigarette package or newspaper, will tend to fall to the floor or seating surface when the bus is on a level surface. If it is necessary to remove the panel to service components located on the rear bulkhead, the panel shall be hinged and shall be able to be removed and replaced by a 3M mechanic in 2 minutes. Panel shall be retained in place utilizing standard 5/16” square drive flush-recessed mounted latches.

**TS 9.4.4.5 Headlining**
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. The headlining panels and ceiling shall have a minimum thickness of 0.10 inch. The method of fastening shall require the approval of SEPTA at the PILOT INSPECTION.

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. Colors, patterns, and materials for the headlining are defined in Attachment Section TS 11.19: Technical Specifications.

**TS 9.4.4.6 Fastening**
Interior panels shall be attached so that unfinished or rough surfaces, to include edges, are not exposed. Panels and trim shall be shaped, sized and attached to eliminate alignment and fit gaps. Panels and fasteners shall not be easily removable by passengers. Interior trim fasteners where required and visible to passengers shall be recessed, cross-head screws. Rivets will not be visible to bus passengers. Fasteners, visible to passengers will be minimized. Ceiling panels shall require engineered fasteners; adhesives, high bond tape and like are prohibited in ceiling panel application.

**TS 9.4.4.7 Insulation**
Any insulation material used between the inner and outer panels shall be fire-resistant, sealed or self-sealing, to minimize the entry of moisture and to prevent moisture retention in sufficient quantities to impair insulation properties. Insulation properties shall be unimpaired by vibration compacting, or settling during the life of the bus. The insulation material shall be non-hygroscopic and resistant to fungus and breeding of insects. The use of formaldehyde foam insulation is precluded.

Any insulation material, blankets or pads used inside the engine compartment shall be encased or sealed in a waterproof, puncture resistant covering, shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations. The insulation material used in the engine compartment shall be fire resistant and not be affected by engine wash procedures. The Contractor shall furnish detailed manufacturer's specifications and installation procedures for the insulation materials and engineering samples for SEPTA's approval at the PILOT INSPECTION.

All insulation materials shall comply with the Recommended Fire Safety Practices defined in FMVSS 302.
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 of Section 6: Technical Specifications. The bus body shall be thoroughly sealed so that the operator or passengers cannot feel drafts during normal operation with the passenger doors closed.

**TS 9.4.5 Floor Covering**

The floor covering shall consist of 0.10 inch thick welded seam, non-skid long life surface that remains effective in all weather conditions and complies with all ADA requirements such as Altro or approved equal. The floor covering color/pattern shall be Genome, TFM 2702 or approved equal. 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. All flooring seams shall be welded using the flooring manufacturers recommended practices and materials. The floor covering shall extend to the top of the side wall cove. The floor covering shall be laid as to minimize transverse seams. A stainless or aluminum strip with a minimum width of one (1) inch shall be placed around each wheel housing, the driver's platform and the dash panel to seal the floor covering. A two (2)-inch, straight line nosing must be maintained + ½” where nosing’s are to be furnished on entrance and exit steps. Step nosing’s and standee line shall be safety yellow. A standee line shall be furnished at the rear of the operator’s platform and shall be at least 2 inches wide and shall extend across the bus aisle. This line shall be welded in. The flooring color/pattern shall be consistent throughout the floor covering.

Any areas on floor, which are not intended for standees, such as areas “swept” during passenger door operation, shall be clearly and permanently marked.

The floor in the operator's compartment shall be easily cleaned and shall be arranged to minimize debris accumulation.

**TS 9.4.6 Passenger Interior Lighting**

The Contractor shall furnish and install an interior LED lighting system to provide general illumination in the passenger compartment of the bus and shall be controlled through the master run and a separate switch.

The interior lighting system shall provide a minimum 17 foot-candle illumination on a 1 square foot plane at an angle of 45 degrees from horizontal, centered 33 inches above the floor and 24 inches in front of the seat back at each seat position. Allowable average light level for the rear bench seats shall be 12 foot candles. Floor surface in the aisles shall be a minimum of 10 foot candles, vestibule area a minimum of 4 foot-candles with the front doors open and a minimum of 2 foot candles with the front doors closed. Interior lighting shall be tested in accordance with criteria in Attachment to Section 6: Technical Specifications. The front entrance area and overhead light shall illuminate when the front door is open and master run switch is in the NIGHT/RUN position. Rear exit area and overhead lights shall illuminate when rear door is activated. The aforementioned lighting shall meet or exceed the applicable ADA wheel chair light requirements.

If applicable, step lighting for the intermediate platform between lower and upper floor levels shall be provided and shall illuminate in DAY/RUN, NIGHT/RUN and PARK positions. The water resistance step lighting shall be flush mounted to minimize tripping and snagging hazard for passengers and shall be shielded as necessary to protect passengers’ eyes from glare.

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.
Lens (light covers) material shall be polycarbonate that shall maintain its appearance and other qualities throughout the vehicle's useful life. Lens shall be designed to effectively "mask" LED lighting elements. Lens shall be sealed to inhibit incursion of dust and insects yet are easily removable for service.

The lenses shall be retained in a closed position by positive means and hardware defined by this specification.

Access panels shall be provided to allow servicing of components located behind light panels where specified and identified to as required from SEPTA at the conclusion of the Pilot Inspection program. The entire light fixture shall be hinged. The hinged base light panel is not a service door as defined herein by SEPTA.

The light fixtures shall meet or exceed the standards for - Fire Retardancy FMVSS 302 and ASTM-E 162, Surface Flammability, Flame Spread Index F-5<150, Docket 90-A. Test data required.

24 volt DC primary wiring shall be individually circuit protected. Said protection shall be installed on the vehicle wiring harness side of the lamp power supply plug. Power supplies and lamp circuits shall be arranged with current limiting or similar means to preclude overheating and/or fires from supplies, lights and fixtures.

The vehicle shall incorporate a system of interior lighting control that facilitates operator comfort and passenger safety. To the end, the vehicle shall be equipped with an interior light management system using selectable power supply driver boards enabling lighting level trimming defined at the Pilot Inspection and thereafter for production of subsequent vehicles. A capped aperture shall be provided for adjustment of dip switches that does not require lighting panel removal. Additionally, an ambient affected, photocell module shall be provided for regulation of night time programmed dimming of interior lighting and preemption of interior lighting application in “Night Park” master switch selection in conjunction with operation in daylight conditions.

The Contractor shall at the pilot construction phase, submit a range of lighting temperature options for property evaluation.

The light system may be designed to form part or the entire air distribution duct.

**TS 9.4.7 Fare Collection**
The Contractor shall provide reinforcement plates and drill mounting holes for SEPTA fare collection equipment. The floor under the fare box shall be reinforced, as necessary, to provide a sturdy mounting platform and to prevent shaking of the fare box. The Contractor shall provide and install farebox quick release hardware and wire harness, reference specification § TS 9.2.6.3. A chassis ground cable shall be provided by the Contractor which is electrically connected to one quick release bolt. The Contractor shall provide the farebox stanchion layout for SEPTA's approval at the PILOT INSPECTION. A dual transfer cutter shall be located in a position convenient to the operator. This equipment is defined in Attachment to Section TS 11.20.

**TS 9.4.8 Access Panels and Doors Interior**
Access for the maintenance and replacement of equipment, shall be provided by panels and doors that appear to be an integral part of the interior. Doors shall be of rugged construction and shall be capable of withstanding severe abuse. Removal of fixtures or equipment unrelated to the repair task to gain access shall be minimized. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's
way. Safety chains shall be provided on downward hinged doors. Panel fasteners shall be standardized so that only one tool is required to service all special fasteners within the bus.

Access doors for the door actuator compartments shall be secured with hand screws or latches, and shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels that are hinged shall be captive in the cover.

Access openings in the floor shall have reusable/replaceable seals in order to prevent entry of fumes and water into the bus interior. Flooring material shall be flush with the floor and shall be edge-bound with stainless steel, or aluminum, to prevent the edges from coming loose. Access openings shall be asymmetrical so that reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor. Latch construction shall preclude damage to latches by the removal and installation of access doors. Access doors shall be designed to trap dirt and debris. Access doors shall have a provision to be opened without prying. The destination sign access door shall be secured using tamper resistant Southco fasteners (Pt# 57-T-10).

**TS 9.5 Passenger Accommodations**

**TS 9.5.1 Passenger Seating**

**TS 9.5.1.1 Arrangements and Seat Style**

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance to the following requirements. The Contractor shall submit seating arrangements for not less than 40 seated passengers. The Contractor shall furnish the detailed seat layouts with the proposal and final acceptance at the PILOT INSPECTION.

The passenger seating shall be USSC 4MA, or AmSeCo Vision, or approved equal. The passenger seats shall be stainless steel with non-padded fabric or cosmetic plastic inserts. The general design of the seat structure shall provide optimum comfort for the passenger. All seats shall have fabric or cosmetic plastic inserts installed in a tamper proof manner. All cushion and back inserts shall be recessed into the stainless steel assembly. All workmanship shall be of the highest quality providing component consistency and freedom from such defects as sharp edges, misaligned sections, etc. Inserts are to fit the shell perfectly to preclude tampering or rattles, and to exclude dirt from entering the insert-shell interface. Seat suspension shall be designed to preclude seat/wall rattles over the life of the bus. Seat assemblies and components of identical seats shall be mechanically interchangeable.

All transverse seats shall be cantilever type mounting, except in the rear section of a low-floor design, rigid enough to prevent pinch hazards between the frame and interior side walls and the hardware shall be stainless steel. The rear section seating may consist of a combination of cantilever and pedestal type mounting. The back of each transverse seat shall incorporate a handhold no less than 7/8” in diameter for standees and seat ingress/egress. The handhold shall not be a safety hazard during severe decelerations. The overall design of the grabrail shall be aesthetically pleasing and enhance the general appearance of the seat. The grabrails shall be readily replaceable but attached securely to provide adequate and firm support.

Passenger seats shall be arranged in a transverse, forward facing configuration, except at the rear wheel housings where aisle-facing seats may be arranged as appropriate with due regard for passenger access and comfort. Other areas where aisle-facing seats may be provided are at wheelchair securement areas and areas where the floor elevation changes more than 8” in the lower portion of the bus. (see Section TS 9.5.4.3).
Single flip style folding seats shall be provided at one seated pair position across from the exit door to accommodate passengers with strollers. Final single flip seat location(s) shall be approved by SEPTA. The single flip style seat(s) shall not be spring-loaded. The design of the seat shall be such that folding and unfolding of the seat can be easily accomplished. The folding seats shall lock in their folded position. The release of a latch mechanism shall be required to fold the seat bottom down. The bottom side of the folding seat assemblies shall be covered with textured aluminum or stainless steel.

Hip-to-knee room measured from the front of one seat back horizontally across the highest part of the seat to the seat or panel immediately in front, shall be no less than 26.5 inches. At all seating positions in paired transverse seats immediately behind other seating positions hip-to-knee room shall be no less than 26.5 inches. SEPTA considers hip-to-knee room of 26.5”, the least desirable minimum. The vehicle manufacturer shall make every effort to maximize hip-to-knee room while maintaining the specified number of seated positions.

Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 inches. Seats immediately behind the wheel housings and modesty panels may have foot room reduced, provided the wheelhouse is shaped so that it may be used as a footrest or the design of modesty panel effectively allows for foot room.

Thickness of the transverse seat backs shall be minimized at the bottom to increase passenger knee room and passenger capacity.
TS 9.5.1.2 Dimensions

The aisle between the seats shall be no less than 20 inches wide at seated passenger hip height. Seat backs shall be shaped to increase this dimension to no less than 24 inches at standing passenger hip height.

Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to the figure above):

The width, W, of the seat shall be 35 inches.

The length, L, shall be 17 ±1 inches.

The seat back height, B, shall be a minimum of 15 inches.

The seat height, H, shall be 17 ± 1 inches.

The foot room, F, shall be specified in TS 9.5.1.1
The seat cushion slope, $S$, shall be between $5^\circ$ to $11^\circ$.

The seat back slope, $C$, shall be between $8^\circ$ to $17^\circ$.

The hip to knee room, $K$, shall be as specified in TS 9.5.1.1.

The pitch, $P$, is shown as reference only.

**TS 9.5.1.3 Structure and Design**

The passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized to increase wheelchair maneuvering room and is completely free of obstructions to facilitate cleaning.

The transverse seat structure shall be fully cantilevered from the sidewall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 inches of the aisle shall be at least 10 inches above the floor. Folding seats used in wheelchair securement areas, as well as, transverse seats mounted in locations at which cantilevered installation is precluded by design and/or structure, need not be cantilevered.

The underside of the seat and the sidewall shall be configured to prevent debris accumulation and the transition from the seat underside to the bus sidewall to the floor cove radius shall be smooth. All transverse objects, including seat backs, modesty panels, and longitudinal seats, in front of forward facing seats shall not impart a compressive load in excess of 1,000 pounds onto the femur of passengers ranging in size from a 5th-percentile female of a 95th-percentile male during a 10g deceleration of the bus. This deceleration shall peak at $.05 \pm .015$ seconds from initiation. Permanent deformation of the seat resulting from two 95th-percentile males striking the seat back during this 10g deceleration shall not exceed 2 inches, measured at the aisle side of the seat frame at height $H$. Seat back should not deflect more than 0.25 inches, measured at the top of the seat back, in a controlled manner to minimize passenger injury. Structural failure of any part of the seat or sidewall shall not introduce a laceration hazard.

The seat assembly shall withstand static vertical forces of 500 pounds applied to the top of the seat cushion in each seating position with less than 1/4-inch permanent deformation in the seat or its mountings. The seat assembly shall withstand static horizontal forces of 500 pounds evenly distributed along the top of the seat back with less than 1/4-inch permanent deformation in the seat or its mountings. The seat backs at the aisle position and at the window position shall withstand repeated impacts of two 40-pound sandbags without visible deterioration. One sandbag shall strike the front 40,000 times and the other sandbag shall strike the rear 40,000 times. Each sandbag shall be suspended on a 36-inch pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10, and 12 inches. Seats at both seating positions shall withstand 4,000 vertical drops of a 40-pound sandbag without visible deterioration. The sandbag shall be dropped 1,000 times each from heights of 6, 8, 10, and 12 inches. Seat cushions shall withstand 100,000 randomly positioned 3-1/2-inch drops of a squirming, 150-pound, smooth-surfaced, buttocks-shape striker with only minimal wear on the seat covering and no failures to seat structure or cushion suspension components.

The back of each transverse seat shall incorporate a handhold no less than 7/8 inch in diameter for standees and seat access/egress. The handhold shall not be a safety hazard during severe decelerations. The handhold shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4 inches long that may be grasped with the full hand. This handhold shall not cause a standee using this assist to interfere with a seated 50th-percentile male passenger. The handhold shall also be usable by a 5th-percentile female, as well as by larger passengers, to assist with seat access/egress for either transverse seating position. The upper rear portion of the seat back and the seat back handhold immediately forward of transverse seats shall be padded and/or constructed...
of energy absorbing materials. During a 10g deceleration of the bus, the HIC number (as defined by SAE Standard J211a) shall not exceed 400 for passengers ranging in size from a 5th percentile female through a 95th percentile male. The seat back handhold may be deleted from seats that do not have another transverse seat directly behind and where vertical assist is provided in accordance with Section TS 9.5.2. Armrests shall not be included in the design of transverse seats.

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 operator's barrier, or a modesty panel and these fixtures perform the function of restraining passengers from sliding forward off the seat. Armrests are not required on longitudinal seats located in the wheelchair parking area that fold up when the armrest on the adjacent fixed longitudinal seat is within 1-1/2 to 3-1/2 inches of the end of the seat cushion. Armrests shall be located from 7 to 9 inches above the seat cushion surface. The top and sides of the armrests shall have a minimum width of 1 inch and shall be free from sharp protrusions that form a safety hazard.

Seat back handhold and armrests shall withstand static horizontal and vertical forces of 250 pounds applied anywhere along their length with less than 1/4-inch permanent deformation. Seat back handhold and armrests shall withstand 25,000 impacts in each direction of a horizontal force of 125 pounds with less than 1/4-inch permanent deformation and without visible deterioration.

At SEPTA's request, a test report shall be provided by the Contractor that fully documents compliance with all the requirements defined above upon request. The test report shall contain a record of all testing activities, test diagrams, testing equipment, as well as test data related to loads, deflections and permanent deformation of the seat assembly. The report shall include a statement of compliance with the requirements of this Section of Section 6: Technical Specifications.

**TS 9.5.1.4 Construction and Materials**

Seat shall be constructed with materials that comply with the physical test. Selected materials shall minimize damage from vandalism and shall reduce cleaning time. The seats shall be attached to the frame with tamperproof fasteners. Coloring shall be consistent throughout the seat material, with no visually exposed portion painted. All visually exposed metal of the standard seat structure including mounting brackets and other components shall be aluminum or stainless steel. The seat, and back inserts shall be contoured for individuality, lateral support, and maximum comfort and shall fit the framework to reduce exposed edges.

All seat inserts shall be treated with an anti-microbial solution/coating design to be effective for the basic material life.

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 1/4-inch. Seat covering materials shall be selected on the basis of durability, ease of maintenance, and pleasing texture and appearance. The upholstery material shall come into contact with the frame to maximize the amount of upholstered surface that is in contact with the seated passenger. The seat back and seat back handhold immediately forward of transverse seats shall be constructed of energy absorbing materials to provide passenger protection and, in a severe crash, allow the passenger to deform the seating materials in the impact areas in accordance with the Knee Impact and Head Impact Criteria requirements of Section TS 9.5.1.3. Complete seat assemblies shall be interchangeable to the extent practicable. Seats must be designed for easy removal for cleaning and replacement. Seat inserts and back inserts shall be securely fastened and shall be detachable by means of a simple release mechanism employing a special tool so that they are easily removable by maintenance staff and not by the passengers. The inserts shall be injection molded or fiberglass construction. Additional construction details,
color of the seat material and optional safety padding are defined in Attachment to Section 6: Technical Specifications.

**TS 9.5.2 Passenger Assists**

**TS 9.5.2.1 General**

Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and the 5th-percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of seat back assist (see Section TS 9.5.1.3) or as a separate item so that a 5th-percentile female passenger may easily move from one assist to another using one hand and the other without losing support. All handholds and stanchions shall be brush finish stainless steel. All associated hardware shall be stainless steel. All clamps shall be stainless steel.

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1-1/4 and 1-1/2 inches or shall provide an equivalent gripping surface with no corner radii less than 1/4 inch. All passenger assists shall permit a full hand grip with no less than 1-1/2 inches of knuckle clearance around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items and shall be capable of passing the NHTSA Drawstring Test.

Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. Passenger assists shall be designed to minimize glare in the Operator’s area to the extent possible (see Section TS 9.6.1.1). With the exception of seat and door handholds, all areas of the passenger assists that are handled by passengers including functional components used as passenger assists shall be made of stainless steel. Seat handholds may be of the same construction and finish as the seat frame. Door mounted passenger assists shall be made of stainless steel, or steel and be powder coated bright yellow. Assists shall withstand a force of 300 pounds applied over a 12-inch lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads, and other fasteners used on the passenger assists shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

**TS 9.5.2.2 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 on farther inboard than 6 inches from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assist and the assists on the wheel housing or on the front modesty panel.

**TS 9.5.2.3 Vestibule**

The aisle side of the operator's barrier, the wheel housings, and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 inches of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through
the fare collection procedure. Passengers shall be able to lean against the assist for security while paying fares. The assist shall be no less than 36 inches above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the operator's barrier, wheel housings, or front modesty panel.

**TS 9.5.2.4 Rear Doorway**
Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists no less than 3/4 inch in width and shall provide at least 1-1/2 inches of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 inches from the outside edge of the rear doorway.

**TS 9.5.2.5 Overhead**
Except forward of the standee line and at the rear door, a continuous, full grip, overhead assist shall be provided. This assist shall be convenient to standees anywhere in the bus and shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 inches above the floor.

In areas of the vehicle where elevated seating is utilized alternate stanchion configurations may be considered to eliminate low head clearance injuries.

Straps shall be provided for sections where vertical assists are not available and for the use by passengers that cannot reach to 70 inches. A minimum total of eighteen (18) overhead vertical assist straps in the lower deck area shall be provided. A location or fixing collar shall be arranged to prevent axial movement of the strap elements. Exact number of straps shall be determined based on clear floor space of 0.5 square feet per passenger in the area where vertical stanchions are not available, (usually the C/S, S/S wheelchair areas and isles). Vertical assist straps shall be constructed of flexible nylon webbed material a minimum of one inch (1”) wide and be of sufficient construction to withstand the rigors of daily use in transit service.

Overhead assists shall simultaneously support 200 pounds on any 12-inch length. No more than 5 percent of the full grip feature shall be lost due to assist supports. The straps shall be black Nylon, thickness of 0.13 inches, stitch type 301 with minimum 8 stitches per inch. All edges sewn per ASTM-D6193.

**TS 9.5.2.6 Longitudinal Seats**
Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheelchair securement. Assist 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 forty two (42) inches apart or functionally continuous for a 5th percentile female passenger. A minimum of 26 passenger assists shall be provided.

**TS 9.5.2.7 Wheel Housing Barriers/Assists**
Passenger assists shall be mounted around the exposed sides of the wheel housing which shall also be designed to prevent passengers from sitting on wheel housings. Such passenger assists shall also effectively retain items, such as bags and luggage, placed on top of wheel housing.

**TS 9.5.3 Passenger Doors**
TS 9.5.3.1 General and Safety

Two doorways shall be provided in the curbside of the bus for passenger ingress and egress. The front doorway shall be forward of the front wheels and located so that the operator will be able to collect or monitor the collection of fares. Passenger doors and doorways shall comply with ADA requirements.

All door engines shall be Vapor Bus International full electric type. The electric engine controls shall be applied and interfaced in a way that supports current electro-pneumatic specification compliant controls schemes and routines. Door safety release and controls shall operate and interface to the electric engine applications seamlessly. The electric engine interface module shall be arranged for easy and direct maintenance access. The system shall support separate opening and closing speed and cushioning controls. The control systems shall fully support 3rd party meta and parametric data required to affect a system wherein all normal/expected and anomalous conditions may be detected and reported as required.

The rear door actuation system shall be supervised by an electronically controlled Sonar field regulated system (Vapor Class System) that shall control the stop and reverse functionally without the door panel coming into physical contact with passengers. The Class system control module shall be arranged on a stand-alone bracket, securely mounted and its status function panel shall be fully readable, unobstructed from the units dedicated isle facing access panel. Two (2) impulse actuated bladders and sensors shall be provided for base door to person contact. This system upon actuation shall operate as a standard impulse contact system. Vapor Class System Control cutout switch shall be arranged and located in the AVM/L cabinet and labeled CLASS CONTROLLER ON/OFF.

All door system limit switches shall be proximately type magnetic or capacitive. Switches shall be provided with local indication. The door engine zones shall be arranged in a logical, orderly fashion that eliminates operating and wiring component interference and contact with moving parts. All door engines and support chassis shall be removable without obstruction. Pneumatic supply lines and wiring harnesses shall be arranged to permit the door engine/base plate to be removed as a module through disconnects and plugs.

Both door positions shall be equipped with two (2) at each door position Dialight, part# VSL-17B-CC-37B-809 lamp(s) mounted at the interior upper inside horizontal lintel. Lighting shall be supplied from a 28 volt, nominal source.

The front and rear passenger doors shall have passenger assist railings. Said railings shall be powder coated yellow.

The rear doorway centerline shall be rearward of the point midway between the front door centerline and the rearmost seat back.

The front door shall be the slide and glide, two-section type with two-piece glazing. This door will be located on the right side ahead of front axle. The front door sections (leafs) shall be 2 piece glazing per panel and shall permit the seated operator in prescribed height range full view of curb and curb capping. The lower front door glazing shall be planar with no curves(ing) or separator mullions.

Durable rubber weather stripping two to three (3) inches in width shall be provided on each mating edge of the forward panels.

The front door shall be air-operated and under the direct control of the operator by means of a five (5) position controller. The operator's door control shall be mounted on the operator's left side panel. In standby mode, an
electro-pneumatic control switch, in reach of the street side driver’s window, shall permit the front door air supply to pressure protect supply and exhaust the front door actuator cylinder. The E-P control if active upon master switch set for run mode shall cause the front interior and front marker lights to flash until reset to non-dumped state and local pneumatic control pressure switch has reached the safe operating point. Restoring the switch shall recharge and close the front doors.

A manually operated door-bleed valve located at the operator's left side, in an easily accessible position, shall be installed. It will release air pressure on the front door if the control valve becomes inoperative, allowing the front door to open manually.

The rear door shall be two-section type or slide and glide, it shall open outward. The rear door shall be located on the right side, between the front and rear axle. The rear door panel(s) shall be solid (no glazing) and seamlessly built and integrated into the door panels. The solid lower panel shall occupy 50% of the total combined door surface. Glazing shall be installed to the upper 50% area only.

Durable rubber weather stripping two inches to three inches in width shall be provided on each mating edge of the door panels, with sensitive edge sensors in the stripping on panels for the rear door.

The rear door shall be activated with the operator controlling the opening and closing of the rear door using door control 5 position door controller. The door shall begin closing from "full open" position in operator operated mode within 2.0 - 2.5 seconds. The door opening and closing speed shall be easily adjustable from the door controller software. The door acceleration rates shall be adjustable in opening and closing. The operator's door controller shall be mounted on the operator's left switch panel. The rear door emergency release valve shall be situated at the rear door at a location approved by SEPTA. Upon application of the emergency release it shall be possible to apply a pushing force to the center of the door panels as to cause displacement and facilitate necessary escape. The door panels shall be equipped with placards indicating emergency door displacement procedure. The rear door operating system includes a brake interlock system, an accelerator interlock system and sensitive edges. The rear door operating system shall also include a rear door inhibit system (low speed switch) which shall prevent the rear door from actually opening unless the bus has come to a complete stop (0-1 mph).

To preclude movement of the vehicle, the interlock system shall not release until the rear door cycle is completed and the door is positively closed and locked.

Upon park brake release, antitheft switch key switch set to run, PBSS range select obtain; the activation of the interlock overrule, release or cutout switch shall cause the bus video system to “tag” the event under to standard tagging rules.

The rear door cut-out switch shall be located behind the front destination door. The rear door cut-out switch shall inhibit rear door operation and override the rear door interlock system. A tell-tale light shall illuminate on the driver’s dash panel indicating that the cut-out switch is activated.

**TS 9.9.5.3.1 Door Abnormal State Operation Detection**

Upon occurrence of the following operational condition(s):

i) Five position door control set from operate to close prior to 85° (door full open)
ii) Interlock overrule switch enabled
iii) Drive shaft frequency > 17 Hz
Conditions: i, ii, iii-IVS/IVN system shall log fault code.
IVN system shall initiate video tag directive to the DVR system.

**TS 9.5.3.2 Materials and Construction**
Structure of the doors, their attachments, inside and outside trim panels, and any mechanism exposed to the elements shall be corrosion-resistant. Door panel construction shall be of corrosion-resistant metal or reinforced non-metallic composite materials. The doors, when fully opened, shall provide a firm support and shall not be damaged if used as an assist by passengers during ingress or egress. The front leaves of the passenger doors shall overlap the rear leaves.

**TS 9.5.3.3 Dimensions**
When open, the doors shall leave a clear opening of no less than seventy-six (76) inches ± 1 inch in height. The clear opening widths, including door-mounted passenger assists, shall be no less than thirty-one point seventy-five (31.75) inches ± 1 inch on front doors and shall be no less than twenty-four (24) inches on rear doors. Projections on doors and in floor ingress/egress step area shall not form a hazard to passengers. Doors must be in compliance with ADA requirements.

**TS 9.5.3.4 Door Glazing**
The upper section of both front and rear doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section. The edge of a six (6) inch high curb shall be visible to the seated operator through the closed door when the bus is twelve (12) inches from the curb. The lower section of the rear door shall not be glazed.

The front door panel glazing material shall have a nominal ¼ inch or 6 mm thick laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 2 and the Recommended Practices defined in SAE J673. All door glazing shall be fitted with dry seal gasketing.

Glazing material in the rear doorway door panels shall be the same material, thickness and color as the side windows defined in Section TS 9.7.4.2.

**TS 9.5.3.5 Door Projection**
Exterior projection of the doors shall be minimized and shall not exceed 13 inches during the opening or closing cycles or when doors are fully opened. Projection inside the bus shall not exceed 23 inches. The closing edge of each door panel shall have no less than 2 inches of soft weather stripping. The doors, when closed, shall be effectively sealed to prevent the entrance of air, water objectionable noise and keep ice/snow from forming on the ingress/egress step edge. The hard surfaces of the doors shall be at least 4 inches apart. Requirements for sensitive door edges are defined in Section TS 9.5.3.7.

**TS 9.5.3.6 Door Height above Pavement**
It shall be possible to open and close either passenger door when the bus loaded to GVWR is not knelt and parked with the tires touching an 8-inch-high curb on a street sloping toward the curb so that the street side wheels are 10 inches higher than the right side wheels.

**TS 9.5.3.7 Closing Force**
Closing door edge speed shall not exceed 19 inches per second. Power close rear doors shall be equipped with a sensitive edge or other obstruction sensing system such that if an obstruction is struck by a closing door edge, the doors will stop and/or reverse direction prior to imparting a 10-pound force on 1 square inch of that obstruction. If the device senses an obstruction when operating on its closing cycle, the system shall be configured to stop and reverse the doors to a locked open condition. During the aforementioned obstruction sense condition, an alarm and indicating lamp shall activate so long as the condition exists at the sensitive edges. If the door safety system operates under these conditions, the operator must proceed through a reopen-reclose cycle at the switch in order to close the doors. Whether or not the obstruction sensing system is present or functional it shall be possible to withdraw a 1-1/2 inch diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 25 pounds.

**TS 9.5.3.8  Actuators**

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the requirements of Section TS 9.6.1.6. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be able to be rebuilt. 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 air system and to muffle sound. Actuators and the door mechanism shall be designed to operate without a Class 3 failure for 150,000 miles on the design operating profile.

**TS 9.5.3.9  Emergency Operation**

In the event of an emergency, it shall be possible to open the doors manually from inside the bus using a force of no more than 25 pounds after actuating an unlocking device at each door. The unlocking devices 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 entrance and exit areas. When the rear door emergency device is actuated, the door interlock throttle system shall return the engine to idle and the door interlock brake system shall apply to stop the bus. When the front door emergency device is actuated only the door interlock throttle system shall be actuated. Locked doors shall require a force of more than 100 pounds 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, engines, and complex mechanism.

**TS 9.5.3.10  Automatic Passenger Counting System (APC) - General Requirements**

The Contractor shall install and arrange Urban Transportation Associates, Inc. (UTA) autonomous automatic passenger counting system (APC). At the physical layer the APC system shall consist of the following components:

1.) Antenna. Unit shall be a single radome containing GPS/Wi-Fi/Cellular antenna ports. Unit shall be mounted to the exterior vehicle roof with unobstructed skyward view. Ground plane not required. Unit shall be arranged for proper serviceability per requirements pursuant to section- TS 9.9.4.4 AVL/AVM and Radio/Video Surveillance Compartment Cabinet.

2.) UTA Model 30 CPU Controller. Unit shall be installed in accordance with section TS 9.9.4.4 installation and power conditioning requirements.

3.) UTA Smart Sensor/Analyzer Module. Unit shall be installed in accordance with section TS 9.9.4.4 installation and power conditioning requirements. Unit shall be arranged as to permit sensor indication visibility for observation.

4.) Two (2) overhead, lintel mounted downward faces detectors.

APC Sensors. Overhead, lintel mounted downward facing detectors, One (1) sensor assembly per doorway
5.) All interconnecting and power/control cabling. Interconnecting and power/control cabling shall include: 12V constant (battery) power, antenna cabling between Model 30 CPU and roof-mounted antenna, cabling between Smart Sensor Analyzer and APC sensors, and interface to bus multiplex system providing discrete digital vehicle door open/close indication, wheelchair ramp stow/deploy indication, bike rack stow/deploy indication.

6.) All external system sensors and switches shall be capacitive or proximity types and shall be fully environmentally sealed and suitability UV protected.

### TS 9.5.4 Accessibility Provisions

**TS 9.5.4.1 General**
The design and construction of the bus shall be in accordance with all requirements defined in 49 CFR, Part 38, including Subpart B: ADA Accessibility Specifications for Transportation Vehicles - Buses, Vans and Systems, current version. Space and body structural provisions shall be provided at the front door of the bus to accommodate the wheelchair loading system. The Proposer shall provide a plan, including layout drawings for entry, maneuvering, parking, and exiting of wheelchair passengers, to show compliance with ADA regulations. All ADA regulation dimensions shall be considered a minimum. The LIFT U, LU-6 rising floor ramp shall be provided or contractor equal as approved by SEPTA.

**TS 9.5.4.2 Loading System**
An operator-controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely, and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street or curb.

The wheelchair loading system shall be located at the front door.

The wheelchair ramp shall be rated for a minimum capacity of 600 lbs. The ramp shall have a clear width of not less than 30.5 inches and be equipped with side barriers at least two (2) inches high. The ramp shall be illuminated.

When the system is not in use, the passageway shall appear normal. In the stored position of the ramp, no tripping hazards shall be presented and any resulting gaps shall be minimized. The ramp control (hood guarded toggle switch) shall be located on the operator’s dash panel and shall be simple to operate with no complex phasing operations required. Ramp controls will be operational only when the propulsion system is in neutral, the parking brake is set and the front doors are open. The ramp logic shall be programmed to kneel the bus prior to ramp deployment. When “ramp deployment” is activated the bus shall kneel prior to the ramp deployment and the control system shall require Park Brake applied, zero velocity as the first enabling condition and the applicable control elements of § **TS 8.1.2.4.1 Kneeling Control Function** shall be integrated into the holding function up to the final interlock release condition of the Parking Brake release.

When “ramp-stow” is activated the ramp shall stow completely prior to the kneeler recovery. The kneel function will be disabled when the platform is extended. To alert passengers and pedestrians, an audible alarm will sound and a minimum, two one-half (2.5) inch diameter LED lamp will flash as the ramp is being extended or retracted. The loading system operation shall be under the surveillance and complete control of the operator. The bus shall be prevented from moving during the loading or unloading cycle by a throttle and brake interlock system. The wheelchair loading system shall not present a hazard, nor inconvenience any passenger. A dedicated, ramp interlock system shall prevent the ramp from being operated when a passenger is on the ramp/platform. The hazard lamps
shall flash automatically upon activation of the ramp. The hazard lamps shall continue to flash throughout the ramp operation cycle until the ramp is fully stowed and the brake interlock is released.

A passenger departing or boarding via the ramp shall be able to easily obtain support by grasping the passenger assist located on the doors or other assists provided for this purpose. The platform shall be designed to protect the ramp from damage and persons on the sidewalk from injury during the extension/retraction or lowering/raising phases of operation. The loading platform shall be covered with a replaceable or renewable, non-skid material with a static dry coefficient of friction, of no less than 1.25. The ramp floor system shall be fitted with devices to prevent the wheelchair from rolling off the sides during loading or unloading. Deployment or storage of the ramp shall require no more than 10 seconds. The device shall function without failure or adjustment for 500 cycles or 50,000 miles in all weather conditions on the design operating profile. A manual override system shall permit unloading a wheelchair and storing the device in the event of a primary power failure. The manual operation of the ramp shall not require more than 32 lbs. of force and shall be accomplished within three (3) minutes, start to finish without the use of pumps or tools other than a pull handle/strap.

Hydraulic systems incorporated in the loading system mechanism shall comply with the requirements defined in Section TS 7.6.7. The ramp assembly components shall be replaceable within 30 minutes by 3M mechanic. The wheelchair loading system shall have a device that counts the total number of times the system has been cycled. The counter shall be in a convenient location for maintenance personnel to view.

**TS 9.5.4.3 Wheelchair Accommodations**

The vehicle shall be equipped with two (2) forward facing wheelchair securement areas with a "clear floor space" no less than fifty (50) inches long and thirty (30) inches wide if the proposed seat layout allows. These areas shall be clearly marked as wheelchair securement areas and signs will request other passengers to make them available for wheelchair use.

The wheelchair securement system shall feature a four (4) point tie down system to limit the movement when secured and have the capability to secure a wheelchair passenger in one and half minutes or less. The restraint belt system shall be USSC VPRO, AmSeCo ARM. The forward facing tie downs shall be the Q'Straint Part# Q060002 retractor unit. The tie downs shall include four (4) retractable and permanently affixed belts to secure the wheelchair. The front restraint belts shall be attached or fitted to a telescoping bar or arm that shall not pose an aisle space restriction or standing passenger hazard when the telescoping unit is not being used by a wheelchair passenger. The telescoping arm shall be permanently attached to the floor at each Wheelchair restraint location. The restraint belts shall be retractable and include knobs to draw down and lock the front restraint belts.

Permanently mounted and retractable passenger lap and shoulder belts will be provided. The shoulder bolt retractor shall be affixed to the side wall with a step off (hat bracket) that allows the retractor to swivel freely to accommodate passengers of differing heights. The harness and lap belts shall interlock with a single point quick release. In their stowed position the restraint belts along with the lap and shoulder belts will not contact the floor of the bus. A retainer shall be provided to stow the shoulder harness locking end when not in use.

Folding seats shall be provided in the wheelchair securement areas to allow the areas to be used as normal seat locations when not in use for wheelchair securement. The seats shall not be spring-loaded. The design of the seat shall be such that folding and unfolding of the seat can be easily accomplished by an occupant of a wheelchair. The folding seats shall lock in their folded position. The release of a latch mechanism shall be required to fold the seat bottom down. The bottom side of the folding seat assemblies shall be covered with textured aluminum or stainless steel, to which an instruction plate shall be attached, showing step by step procedures for the proper securement of the wheelchair.
A chime tape switch shall be attached to the bottom of each longitudinal folding seat or seat assembly. The tape shall be conveniently located for the user. The tape switches shall simultaneously sound a double chime and illuminate a “WC STOP REQUEST” lamp on the dash to alert the operator to the pending departure of the wheelchair passenger. Upon activation of the chime tape switch the stop request sign shall illuminate. Switch location shall require SEPTA approval coincident to the Pilot Bus construction.

**TS 9.5.4.4 Interior Circulation**

Maneuvering room inside the bus shall accommodate easy travel for a passenger in a wheelchair from the loading device through the bus to the designated parking area, and back out. No portion of a standard wheelchair or its occupant shall protrude into the normal aisle of the bus when parked in the designated parking space(s). As a guide, no width dimension should be less than 33 inches. Areas requiring 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 inches and in the parking area where 180-degree turns are expected, space should be clear in a full 60-inch-diameter circle. A vertical clearance of 12 inches above the floor surface shall be provided on the outside of turning areas for wheelchair footrest.

**TS 9.5.4.5 Passenger Information**

ADA priority seating signs as required and defined by 49 CFR, Paragraph 38.27 shall be provided to identify the seats designated for passengers with disabilities.

All longitudinal and forward facing ADA movable seat frame (flip seats) seating shall be permanently molded in the cosmetic plastic insert or embroidered for the fabric insert as follows and depicted:
Wheelchair symbol dimensions:

* Width - widest part of symbol (back of wheel to tip of toe) 3.75"
* Height - longest part of symbol (top of head to bottom of wheel) 4.5"
* “PRIORITY SEATING & " YIELD THESE SEATS" font: Arial Modified type; Size108
* “For Persons With Disabilities & Seniors"  font: Arial Modified type; Size 80
* Wheelchair and script yarn color: Yellow 1136

*Part number for seat material in attachment to § TS 11.21; Technical Specification.

Requirements for a public information system in accordance with 49 CFR, Paragraph 38.35 shall be provided as required in Section TS 9.9.5.

Requirements for a stop-request passenger signal in accordance with 49 CFR, Paragraph 38.37 shall be provided as required in Section TS 9.9.3.

Requirements for exterior destination signs in accordance with 49 CFR, Paragraph 38.39 shall be provided as required in Section TS 9.9.2.

**TS 9.6 Operator Provisions**

**TS 9.6.1 Operator’s Area**

**TS 9.6.1.1 General**

The operator’s work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black or dark gray in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the operator’s area shall be avoided. 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. The operator shall control interior lighting located ahead of the standee line.

**TS 9.6.1.2 Visors**

Adjustable sun visor(s) shall be provided for the windshield. 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 made easily by hand with positive locking and releasing devices and shall not be subject to damage by over-tightening. Sun visor construction and materials shall be strong enough to resist breakage during adjustments. Visors, when deployed, shall be effective in the operator's field of view at angles more than 5 degrees above the horizontal.
An adjustable roller type sunscreen shall be provided over the operator’s side window. The sunscreen shall be capable of being lowered to the midpoint of the operator’s window. To secure and stabilize the screen, it shall be attached to thin metal rods on each side of the window, or a scissors stabilizer within the blind assembly. Once lowered, the screen shall remain in the lowered position until returned to the stowed position by the operator. The roll down sunscreen shall be made of vinyl impregnated cloth of sufficient weight to withstand significant use without damage.

**TS 9.6.1.3 Operator's Controls**

All switches and controls necessary for the operation of the bus shall be conveniently located in the operator's area and shall provide for ease of operation. Switches and controls shall be essentially within the hand reach envelope described in SAE Recommended Practice, J287, Driver Hand Control Reach. Controls shall be located so that boarding passengers may not easily tamper with control settings.

All operators’ indication lamps and switches shall be English Language printed or screened labels. Upon activation of indication and switch functions, a back lighted dash gauge integrated message shall be broadcast (in English) for the duration of defined events. The back light shall set to flash when active. The Contractor shall arrange a priority program assuring safety or shutdown routines active shall interrupt lower priority active prompting. Additional system requirements as specified by § TS 9.6.1.8 On-board Diagnostics and Message Display Terminal, TS 9.9.7 Intelligent Vehicle Systems § TS 9.6.1.5 Switches and Controls and § TS 9.6.1.7 Instrumentation.

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

Controls for engine operation shall be closely grouped within the operator's compartment. These controls shall include separate master run switch and start switch or button. The run switch shall be a four-position rotary switch with the following functions:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STANDBY/Off</strong></td>
<td>Propulsion, HVAC and support systems off, except power available for the passenger interior lighting, stoplights, turn lights, hazard lights, radio, silent alarm, horn, fare box, AVL/AVM system, camera security systems and vehicle multiplex system are powered to orderly shutdown time outs. Automatic front door air dump applied.</td>
</tr>
<tr>
<td><strong>DAY/RUN</strong></td>
<td>All electrical systems and engine on or enabled, except the headlights, parking lights and marker lights. Daytime running lights (DRL) shall be enabled, on state at park brake release.</td>
</tr>
<tr>
<td><strong>NIGHT/RUN</strong></td>
<td>All electrical systems and engine on or enabled, headlights, parking lights and marker lights enabled, state on. Interior lighting operating ambient compensation mode.</td>
</tr>
<tr>
<td><strong>PARK</strong></td>
<td>Functionally equal to standby, sans electric multiplex system ordered shutdowns, exterior lamps enabled to manual or automatic shutdown.</td>
</tr>
</tbody>
</table>

The door control, kneel control, windshield wiper/washer controls, and run switch shall be in the most convenient operator locations. They shall be identifiable by shape, touch, and permanent markings. Doors shall be operated by a single control, conveniently located and operable in a horizontal plane by the operator's left hand. The setting of
this control shall be easily determined by position and touch. Turn signal controls shall be floor-mounted, foot-
controlled, waterproof, heavy-duty, momentary contact switches.

All panel-mounted switches and controls shall be marked with easily read identifiers and shall be replaceable, and
the wiring at these controls shall be serviceable from the vestibule or the operator's seat. Switches, controls, and
instruments shall be dust- and water-resistant consistent with the bus washing practice described in Section TS
9.4.1.

**TS 9.6.1.4 Anti-Theft Hardware and Performance Requirement**

In order to reduce the risk of injury and property damage associated with vehicle theft the Contractor shall provide
an Anti-Theft system. The operator's interface shall be lock and key arrangement, (Chicago Lock, Model Number,
ACE II, No. 4072-1-DC), and a procedure for vehicle starting as follows:

Propulsion System Start Mode: Place the anti-theft key to the RUN position while depressing the brake pedal 1 to
5# application. Push the start button, when the vehicle starts the operator can select a propulsion system shift range
only when the key is in the captive or run position. The vehicle shall be interlocked so that the bus will not shut
down without the key set in the released position. The key in the release position shall set the propulsion system
control to neutral.

Propulsion System Stop Mode: Turn Master switch to the STAND BY position, the propulsion system shall be
designed to reset to neutral if there is any possibility that the mechanical arrangement of the valve body can cause a
mechanical range to be established during restart.

Key Quantity: The Contractor shall supply 2 keys per vehicle and 1 spare key set per 2 delivered vehicles. All keys
shall be stamped. "SEPTA-DO NOT DUPLICATE”.

**TS 9.6.1.5 Switches and Controls**
The switches and controls shall be properly identified. They shall include but not be limited to the following:
- Master run switch-STANDBY, DAY RUN, NIGHT RUN, NIGHT PARK.
- Start button or switch.
- Turn signal waterproof, foot controlled switches. (No labeling required)
- Interior lighting switches – Normal/Off/Battery (Note: Battery option power is enabled upon engine not
  running flag set and Master Switch set to OFF)
- Instrument panel lighting intensity control (Dimmer Switch).
- Operator's area light switch.
- Hazard Warning Switch.
- Horn button captive in steering wheel hub, protected to preclude accumulation of transfer punches in
  steering wheel hub.
- Foot - controlled waterproof headlight dimmer switch. (No labeling required)
- High idle switch.
- Diagnostic light panel test switch (Unless otherwise provided for).
- Exit door over-ride switch.
- Magnetic brake over-ride switch. (Momentary brake interlock switch w/high decibel audible alarm
  coincident with activation).
- Climate control switch, (on/off toggle switch).
- "Stop Request" cancel switch.
- Front door switch (extra - access through operator's window).
- Emergency alarm switch (no identifier allowed).
• Help Light Switch (with protective cover).
• Accelerator Pedal. (No labeling required)
• Brake Pedal. (No labeling required)
• Passenger doors (Single Control)
• Windshield wipers, variable range control, w/ integrated park function, intermittent control-wipers on shall cause headlamps and exterior lighting to operate coincidently.
• Windshield washers.
• Defroster control.
• Operator's heat control.
• Parking/emergency brake control (actuation of brake, not control, shall be indicated to the operator).
• Propulsion system control.
• Front pneumatic and electro-pneumatic door dump valve.
• Public address and stop announcement system/system controls.
• Destination sign controls.
• Wheelchair ramp/lift control panel actuation switch.
• Kneeler Control switch.
• Anti-theft switch.

Switches and Equipment located area of front destination sign:
• ABS override and function.
• Rear door cutout.
• Redundant Destination Controls.

TS 9.6.1.6 Door Control
Doors shall open or close completely in not more than 3.0 seconds from the time of control actuation and shall be subject to the closing force requirements of Section TS 9.5.3.7 and the adjustment requirements of Section TS 9.5.3.8. Front door shall remain in commanded state position even if power is removed or lost.

Operation of, and power to, passenger doors shall be completely and positively controlled by the operator.

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 "Standby" position shall close the doors, deactivate the door control system, release the interlocks, and permit only manual operation of the doors.

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 when the rear door control is activated. The braking effort shall be adjustable with hand tools. Rear doors shall not open until bus speed is below 1 m.p.h, measured by drive shaft frequency.

All passenger door operation shall be monitored by SAE J-1939 compatible transit device or via the multiplex system.

An LED “rear door open” indicator lamp on the operator’s dash panel shall illuminate whenever the rear doors are in any position other than completely closed and locked, regardless of door control position. The indication shall be sufficiently delayed in order to prevent rushing or forcing of the door open process.
No single point failure shall result in violation of any of the following safety criteria:

a) The door must not open with the bus moving more than one and one half (1.5) mph (excluding emergency operation)

b) Under operating conditions the door shall not be in a condition by which it can be inadvertently opened by a passenger or the operator.

c) Actuation of the emergency release handle must not open the door without commencing activation of the brake and accelerator interlocks, unless the master switch is off.

d) Actuation of the emergency release handle must not fail to allow passengers to manually open the door.

e) During normal rear door operations, the door must not fail to open when there is an obstruction between the door panels while closing.

f) Normal door opening (below 1 mph) must not occur without commanding activation of the brake and accelerator interlocks.

Any and all single point failures in the proposed door system (electrical, mechanical or pneumatic) shall be listed and categorized e.g. Class I, II, III or IV failure. Proposers shall certify and warrant that their proposed passenger door control systems (front or rear) are safe and reliable for use on a heavy duty Transit Bus operating in SEPTA's operating environment and duty cycle.

**TS 9.6.1.7 Instrumentation**

The instrument gauges and indications shall be connected to sensors and/or data links via J1939 and a facility for CAN open messaging shall be provided. The speedometer with an integrated message display terminal, air pressure gauge(s), message display terminal (if messaging requirements exceed speedometer capabilities) and certain indicator lights shall be located on the front cowl immediately ahead of the steering wheel. The speedometer message display terminal (and engine compartment Tachometer display) shall indicate all system information on all CAN buses including Propulsion, Braking, ancillary, vehicle multiplex and shall include DTC’s, brake sensors, air pressure, engine and propulsion, door position sensors and measurement values. The steering wheel spokes or rim shall not obstruct the operator's vision of the instruments when the steering wheel is in the straight-ahead position. Illumination of the instruments shall be simultaneous with the marker lamps. Glare or reflection in the windshield, side window, or front door windows from the instruments, indicators, or other controls shall be minimized. Instruments and indicators shall be easily readable in direct sunlight. Indicator lights immediately in front of the operator are identified in the following table:
<table>
<thead>
<tr>
<th>Visual Indicator</th>
<th>Audible Alarm</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back-Up</td>
<td>Backup Alarm</td>
<td>Reverse gear is selected</td>
</tr>
<tr>
<td>Hazard</td>
<td>Discreet Audible Alarm</td>
<td>Four-way flashers activated</td>
</tr>
<tr>
<td>High Beam</td>
<td>None</td>
<td>Headlamp high beams activated</td>
</tr>
<tr>
<td>Kneel</td>
<td>Kneel Horn</td>
<td>Suspension kneeling system activated</td>
</tr>
<tr>
<td>Left Turn Signal</td>
<td>Discreet Audible Alarm</td>
<td>Left turn signal activated</td>
</tr>
<tr>
<td>Parking Brake</td>
<td>None</td>
<td>Parking brake is activated</td>
</tr>
<tr>
<td>Rear Door</td>
<td>None</td>
<td>Rear passenger door is not closed and locked</td>
</tr>
<tr>
<td>Right Turn Signal</td>
<td>Discreet Audible Alarm</td>
<td>Right turn signal activated</td>
</tr>
<tr>
<td>Stop Request</td>
<td>Chime</td>
<td>Passenger stop request has been activated</td>
</tr>
<tr>
<td>Wheelchair Request</td>
<td>Double Chime</td>
<td>Passenger wheelchair stop request has been activated</td>
</tr>
<tr>
<td>Stop Lights</td>
<td>None</td>
<td>Brake lights operational</td>
</tr>
<tr>
<td>ABS</td>
<td>None</td>
<td>ABS activated</td>
</tr>
<tr>
<td>ATC</td>
<td>None</td>
<td>Automatic Traction Control activated</td>
</tr>
<tr>
<td>Interlock Switch</td>
<td>Yes</td>
<td>Upon switch activation</td>
</tr>
</tbody>
</table>

The instrument panel shall include an electronic speedometer indicating no more than 80 mph and calibrated in maximum increments of 5 mph. The speedometer shall be a rotating pointer type, with a dial deflection of 220 to 270 degrees and 40 mph near the top of the dial. The speedometer shall be sized and accurate in accordance with SAE Recommended Practice J678.

The speedometer shall be equipped with an odometer with a capacity reading no less than 999,999 miles.

The instrument panel shall also include air brake reservoir pressure gauge(s) with indicators for primary and secondary air tanks and voltmeter(s) to indicate the operating voltage across the bus batteries. The instrument panel and wiring shall be easily accessible for service from the operator's seat or top of the panel. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

The instrument panel shall include a diesel exhaust fluid gauge. The gauge shall indicate DEF level and also feature a low fluid indicator light. The gauge and indicator light function shall follow the operating protocol established for 2010 EPA certified diesel engines.

See Section TS 7.6.5 for engine compartment gauge requirements.

**TS 9.6.1.8 On-board Diagnostics and Message Display Terminal**

The contractor shall provide a two (2) line, backlit LCD panel for the display of data described herein and throughout. The data display shall list CAN message and other necessary data by CAN specification, noun description for real time and DTC messages in standard nomenclature and decimal formats. The system may be an integrated of a dash board display unit. The display shall scroll up to one thousand (1000) lines of active and inactive data, wherein active and inactive data can be distinguished. The display shall enable up to one hundred (100) custom lines to view for test and repair verification. The display shall provide a CSV data port for export to PC. The Contractor shall furnish the report MS Excel™ template.
The Contractor shall furnish a complete list of all CAN telegrams, their PG/SPN’s, all other word and bit data for all messaging transacted by vehicle systems for every mode of operation. The list shall be formatted by referencing the CAN values to affected systems and the list shall include a standard description (nouns) of the corresponding CAN telegram. The CAN listing shall include source and destination objects, formatted diagramatically indicating all gateways, filters and/or other conditioning devices linked to said CAN source and destination devices.

The Contractor shall furnish a formatted list for approval to SEPTA engineering at the inspection of the Pilot Vehicle at the Contractor’s plant. The Contractor shall provide necessary equipment and personnel required to audit the list as directed to systems and third party destinations in order to prove the fidelity and utility of the data transactions.

All sensors shall be J-1939 type devices, except basic system switches or where integrated into resident devices or systems, e.g., smart dashboard/gauge sets. The bus shall be equipped with an on-board diagnostic system that will indicate conditions that require immediate action by the operator to avoid an unsafe condition or prevent further damage to the bus. This diagnostic system shall have visual and audible indicators. The indicator system shall be J-1939 signal source and shall provide a means to test all discreet sensors. The diagnostic indicator lamp panel shall be located in clear sight of the operator but need not be immediately in front of him. The intensity of indicator lamps 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 have a method of momentarily testing the operation of the lamp. 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. Wherever possible, sensors shall be of the closed circuit type, so that failure of the circuit and/or sensor shall activate the malfunction indicator. Malfunction and other indicators listed in the following table shall be supplied on all buses.

The Contractor shall perform a test at Pilot wherein all CAN J 1939 data source messaging occurring on vehicle systems shall be emulated or otherwise generated for the purpose of verification of all source and destination routing occurring to said signals. A test result and report of same shall be provided to SEPTA Engineering. Space shall be provided on the panel for future installation of 5 additional indicators as the capability of on-board diagnostic systems improves.

<table>
<thead>
<tr>
<th>Visible Indicator</th>
<th>Audible Alarm</th>
<th>Function</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Voltage Equalizer output failure</td>
<td>No</td>
<td>Indicate low diagnostic attention required.</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>ESS/Low Voltage Converter</td>
<td>Yes</td>
<td>Low Voltage Converter-device that utilizes the ESS high voltage battery to power low voltage circuits.</td>
<td>3/Ref. to Req.</td>
</tr>
<tr>
<td>Low Engine Oil</td>
<td>Yes</td>
<td>Engine oil pressure low</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>Hot Engine</td>
<td>Yes</td>
<td>Engine coolant temperature high</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>Low Air</td>
<td>Yes</td>
<td>Air system pressure low in primary or secondary reservoir.</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>Low coolant</td>
<td>Yes</td>
<td>Radiator coolant level low</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>Low Voltage DC Converter Output Fail</td>
<td>Yes</td>
<td>Low voltage failure and/or low output</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>A/C stop</td>
<td>No</td>
<td>Compressor off at high/low switch (if applicable).</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>Kneel</td>
<td>Yes</td>
<td>Kneeling system activated</td>
<td>3/TS 9.8</td>
</tr>
<tr>
<td>Request for Proposal</td>
<td>June 2015</td>
<td>RFP 15-00086-AJKF</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Southeastern Pennsylvania Transportation Authority</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Fire* | Yes | Over temperature in engine compartment. | 1,3 |
| Wheel Chair Stop Request | Yes | Wheel Chair Passenger has activated switch | |
| Next Stop Request | Yes | Passenger has activated pull-cord or button. | |
| Rear Door Obstruction | Yes | Passenger/object caught in door. | 3 |
| Low Propulsion system Fluid | No | Propulsion system Fluid Low.** | 2,3 |
| Propulsion system Pressure | No | Propulsion system fluid pressure low.** | 2,3 |
| Propulsion system shutdown | Yes | Propulsion system deficiency (various).** | 2,3 |
| Auto Stop Announcement | No | Not functioning. | 3 |
| ABS | No | ABS malfunction | 3 |
| ATC | No | ATC malfunction | 3 |
| Brake Pad Warning | No | Indicate service wear limit | 3 |
| Check Engine | No | Engine ECU detects a malfunction | 3 |
| Emissions System Catalyst Soot Filter Warning | Yes | Catalytic muffler temperature and/or pressure has exceeded normal operating parameters | |
| Emission System Catalyst Soot Filter Stop Engine | Yes | Catalytic muffler temperature and/or pressure has exceeded safe operating parameters | 3 |
| Emission System DEF System Failure | No | | 2,3 |
| Emission System Low DEF | Yes | | 2,3 |
| Emission System Controller Failure | Yes | | 2,3 |

Note (1): This fire alarm shall be a separate signal from the other audible alarm(s).
Note (2): May be part of Propulsion system Control system.
Note (3): These devices report to AVM System for export to WLAN. All note(3) events shall export to 3rd party recording device. Resident logs shall be route, block, time-duration, date stamped.

Message Display Terminal Data List  **MDT**

<table>
<thead>
<tr>
<th><strong>Message Data Display</strong></th>
<th><strong>Alarm</strong></th>
<th><strong>Function</strong></th>
<th><strong>Note</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Coolant System Temperature</td>
<td>No$\textsuperscript{c}$</td>
<td>Read data display in ° F</td>
<td></td>
</tr>
<tr>
<td>Engine Lube Oil Temperature</td>
<td>Yes$\textsuperscript{c}$</td>
<td>Read data display in ° F</td>
<td></td>
</tr>
<tr>
<td>Primary Hybrid Drive System Output Temperature</td>
<td>Yes$\textsuperscript{c}$</td>
<td>Read data display in ° F</td>
<td></td>
</tr>
<tr>
<td>Primary Hybrid Drive System Input/Return Temperature</td>
<td>No$\textsuperscript{c}$</td>
<td>Read data display in ° F</td>
<td></td>
</tr>
<tr>
<td>Auxiliary Fan(s) Reported Inoperative</td>
<td>Yes$\textsuperscript{c}$</td>
<td>Report the position number of any inoperative fan(s)</td>
<td>Alarm if high system temperature is reached</td>
</tr>
<tr>
<td>Feature</td>
<td>Status</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>--------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Propulsion System Faults</td>
<td>Yes</td>
<td>Active fault codes only/inactive read as numeric’s</td>
<td></td>
</tr>
<tr>
<td>HVAC TEMP</td>
<td>No</td>
<td>Report ambient and interior Temperatures ° F</td>
<td></td>
</tr>
<tr>
<td>Emissions System Faulted</td>
<td>No</td>
<td>Report non-critical system fault</td>
<td></td>
</tr>
<tr>
<td>Emission system Regeneration Activity</td>
<td>No</td>
<td>Report/record number of requests, completions, in process activities, occurrences, operating hours, regeneration hours, system faults-recorded maintenance resets. Log unit ID upon unit change out.</td>
<td></td>
</tr>
<tr>
<td>Coolant level</td>
<td>Yes</td>
<td>Report coolant low coolant level prior to critical aeration point.</td>
<td></td>
</tr>
<tr>
<td>Charging System Voltage/Current</td>
<td>Yes</td>
<td>Charge voltage source filtered through mux system defined limits/Charge current (Physical Shunt installed) source filtered through mux system defined limits.</td>
<td></td>
</tr>
<tr>
<td>Low Voltage battery Pack Charge Status</td>
<td>No</td>
<td>Battery charge voltage source filtered through mux system defined limits/Battery charge current (Physical Shunt installed) source filtered through mux system defined limits.</td>
<td></td>
</tr>
<tr>
<td>Battery equalizer Status</td>
<td>No</td>
<td>Equalizer reports via CAN data to MDT</td>
<td></td>
</tr>
<tr>
<td>Door Controller status</td>
<td>No</td>
<td>Passes POST-system operating</td>
<td></td>
</tr>
<tr>
<td>Passenger Counter Status</td>
<td>No</td>
<td>Passes POST-system operating</td>
<td></td>
</tr>
<tr>
<td>ESS-DC Converter Failure</td>
<td>No</td>
<td>Converter failure generates failure indication</td>
<td></td>
</tr>
<tr>
<td>Disk Brake Pad Replace Warning</td>
<td>No</td>
<td>Maintainer polled at inspection</td>
<td></td>
</tr>
<tr>
<td>Disk Brake Pad Failure Warning</td>
<td>Yes</td>
<td>Operator Warning</td>
<td></td>
</tr>
</tbody>
</table>

¤ = All status indicators active or dormant shall be able to be polled through the message display system when enabled by maintenance key installed at AVLAVM cabinet.

**TS 9.6.2 Electric Windshield Wipers**

The Contractor shall furnish two (2) high efficiency, electrically operating windshield wiper motors with an "automatic parking" feature. The wiper system shall incorporate two speed (High-Low) and a variable intermittent function. Motors shall be mounted on the inside of the bus and be easily accessible for inspection and maintenance. The windshield wiper system shall meet the requirements of FMVSS#104. A variable intermittent feature shall be provided to allow adjustment of wiper speed for each side between approximately 5 to 60 cycles per minute.

The wiper engine electrical system, all wiring, relays, switches and other equipment shall be arranged for 40 ampere current capacity. The system as delivered shall employ wiper engines operating at 24 volts DC nominal. The wiper system shall be arranged to facilitate system voltage change requiring only relay and/or multiplex system modifications.
No part of the windshield wiper mechanism shall be damaged by manual manipulation of the arms. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. Both wipers shall park along the centered edges of the windshield glass. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service from outside the bus and shall be removable as complete units. The fastener that secures the wiper arm to the drive mechanism shall be corrosion resistant. Operation of wiper system shall cause clearance, ID and headlamp operation.

9.6.2.1 Electrical Wiper Engine Requirements
The Contractor shall furnish two (2) high efficiency, electrically operating windshield wiper motors with an "automatic parking" feature. The wiper system shall incorporate two speed (High-Low) and a variable intermittent function. Motors shall be easily accessible for inspection and maintenance. The windshield wiper system shall meet the requirements of FMVSS#104. A variable intermittent feature shall be provided to allow adjustment of wiper speed for each side between approximately 5 to 60 cycles per minute.

A single electric wiper motor configuration may be utilized provided it meets all other specification and performance requirements of TS 9.6.2.

TS 9.6.3 Windshield Washers
The windshield washer system control valve shall be readily accessible to the seated operator. The windshield wiper arms shall be the wet arm-pantograph type. The windshield washer system shall deposit washing fluid on the windshield and, when used with the wipers, shall evenly and completely wet the entire wiped area. All washer fluid shall be purged from the lines after each use of the washers.

The windshield washer system shall have a minimum 3-gallon reservoir, located for easy refilling from inside or outside of the bus and protected from freezing. Reservoir pumps, lines, and fittings shall be corrosion-resistant, and the reservoir itself shall be translucent for easy determination of fluid level.

TS 9.6.4 Operator’s Lighting
The operator's area shall have a LED light to provide general illumination and it shall illuminate the half of the steering wheel nearest the operator to a level of 20 Lux, foot-candles @ 32-4000° K. This light shall be operator controlled by a switch on the front or side console.

TS 9.6.4.1 Horn
Two-12 volt horns shall be provided. One horn shall sound a low note and the other a high note. The horn’s shall meet the audible requirements of The State of Pennsylvania as defined by CS-75 subpart 75§4535.

TS 9.6.5 Operator’s Seat

TS 9.6.5.1 Dimensions
An orthopedically designed and constructed air ride seat with a high seat back is required. The operator's seat shall be comfortable and adjustable so that persons ranging in size from the 95th-percentile male to the 5th-percentile female may operate the bus. The operator's seat cushion shall have a minimum width of 18 inches, a length of 18 to 20.5 inches, and rearward slope of 7 + 1.5 degrees. The operator's seat back height, measured from the point of intersection of the uncompressed seat cushion with the seat back to the top of the back, shall be no less than 20 inches.
The width of the seat back shall be no less than 19 inches. The angle formed between the seat back and the seat cushion shall be adjustable in the range of 95 to 110 degrees. Height of the seat shall be adjustable so that the distance between the top of the uncompressed seat cushion and the floor may vary, preferably between 15 and 20 inches. The seat shall be adjustable forward and rearward for a minimum travel of 7.5 inches. The seat must be equipped with a manual track release.

The seat controls shall be ergonomically designed so that the operator while seated shall be able to make all 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 9.6.5.2 Structure and Materials**

The operator's seat shall be contoured to provide maximum comfort for extended period of time. Cushions shall be fully padded with at least 3 inches of neoprene foam, or material with equal properties, in the seating areas at the bottom and back. Upholstery shall be ventilated perforated vinyl material. The foam and upholstery material shall meet FMVSS 302 requirements.

The Operators seat shall be USSC G2A or SEPTA approved equal with integrated non-removable headrest. The seat shall have an adjustable air suspension with electro-pneumatic or electric lumbar support. The air suspension/spring and height adjustment may be independent of each other and shall be manually operated. The seat shall be designed and constructed to reduce operator fatigue and lower back injuries and to facilitate operators weighing between 100 lbs. and 400 lbs. The pneumatic suspension system must sufficiently dampen excess seat bounce, resonance and suspension torque and include a quick release valve capable of quickly exhausting air out of the suspension system. The suspension dampening must be adjustable. A secondary method of dampening shall be used to prevent the seat from bottoming out. All components of the suspension system must be integral to the seat assembly. The suspension system area of the operator’s seat must be enclosed with a protective bellows that inhibits dust, debris, hand and foot intrusion to the suspension components.

All visually exposed metal on the operator's seat, including the pedestal, shall be painted aluminum or stainless steel. The seat shall have a protective polycarbonate cover to protect the seat back from abuse and contact with the operator’s barrier. Track stops, if necessary, shall be supplied to prevent the seat from hitting the operator’s barrier.

The operator's seat air-line shall be braided stainless steel, with an in-line filter (100 microns); also, an emergency shut off valve to prevent the seat from falling if its air line is ruptured. The braided stainless steel air-line shall connect to bulkhead fitting that is secured to the floor.

All air bladders shall be constructed of puncture resistant polyurethane. All air bladders will be inflated with pressurized air supplied by the vehicle air system. The use of separate pumps or motors is not acceptable.

Required Type I seat belts shall be fastened to the seat so that the operator may adjust the seat without resetting the seat belt. Seat belts shall be stored in automatic retractors. Seat belts shall be 60” long, minimum.

The seat belt shall have an automatic ratcheting retractor on the left hand side, and the mating part on the right hand side shall be as short as possible.

The seat and seatbelt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210. The seat shall withstand 10,000 impacts of a 40-pound sandbag dropped from a height of 12
inches without visible deterioration. The seat shall be tested in the lowest vertical position and repeated with the seat in the top vertical position.

The 40-pound sandbag shall be suspended on a 36-inch pendulum and shall strike the seat back 10,000 times from distances of 6, 8, 10, and 12 inches. Seat cushion shall withstand 100,000 randomly positioned 3-1/2-inch drops of a squirming, 150-pound, smooth-surfaced, buttocks-shape striker with only minimal wear on the seat covering.

At the request of the SEPTA, the Contractor shall provide a certified test report fully documenting compliance with all the requirements defined above. The test report shall contain a record of all testing activities, test diagrams, testing equipment, as well as test data related to loads, deflections and permanent deformation of the seat assembly. The report shall include a statement of compliance with the requirements of this section.

The operator's seat color shall be black.

**TS 9.6.6 Mirrors**

The bus shall be equipped with a corrosion-resistant, remotely controlled outside rearview mirror on each side of the bus. Mirrors shall permit the operator to view the highway along both sides of the bus, including the rear wheels. The curbside rearview mirror shall be mounted so that its lower edge is no less than 78 inches above the street surface.

A fully adjustable exterior, single vision flat-lens mirror, electrically remote controllable, shall be provided on the left of the operator. The mirror shall be mounted on the left front corner of the bus body so as to give the operator a view of traffic alongside and beyond the bus. The mirror system shall not interfere with the operator's side window operation when tucked in for the bus washer cleaning function.

The curb side mirror shall be a split vision assembly with the upper flat lens adjustment electrically remote controllable and the lower convex lens, manually adjustable.

Provisions shall be made so that the mirrors can be moved out of the way while the bus is being operated through the automatic bus washing machine. The mirrors shall be located to minimize blind spots for the operator in front of mirrors. The mirrors shall be firmly attached to the vehicle to prevent vibration and loss of adjustment. The mirror arms and cabling shall be designed to limit the possibility of damage to the vehicle, the mirrors or bus washing equipment. All mirror arms shall use brackets with built in detents that permit the arm to be stored and returned to its original position without readjustment.

The left side exterior mirror shall be Hadley model# 811RFF, the right exterior mirror shall be Hadley model# 1011RFMC. The exterior mirror size should be the appropriate to meet the operator's line-of-sight needs on the bus curb side.

**TS 9.6.6.1 Exterior Mirror Wiring**

Both exterior mirrors shall be wired through the “A” posts using suitable water tight entrance bushings-no external “A” post connectors are permitted. The termination outside the vehicle frame shall be at the mirror tilt/pan terminal block.

Mirror arm brackets shall be fitted with a removable open back conduit (fastened to the bracket tube) that upon release shall permit the wiring to be exposed for replacement or repair. At each “A” post position there shall be a removable cover plate and at the driver side dash board or base of “A” post a terminal block interfacing the chassis to mirror mechanism wiring. The terminal block for the curb side mirror shall be located at an accessible front sign or front door compartment.
The wire shall be Teflon, Tefzel sheathed or equal and the wiring shall be secured to permit 75# axial strain load. The wiring termination inside the vehicle shall be arranged at the “A” posts structures. Said terminal boxes shall not increase the area of binocular obstruction attending the post structure. Suitable wire covers shall be provided in order to protect the termination at the post area.

**TS 9.6.6.2 Interior Mirrors**
Mirrors shall be provided for the operator to observe passengers throughout the bus without leaving his seat and without shoulder movement. With a full standee-load, including standees in the vestibule, the operator shall be able to observe passengers in the front/entrance and rear/exit areas, anywhere in the aisle, and in the rear seats. Inside mirrors shall not be in the line of sight to the right outside mirror.

The following mirrors for use by the operator under normal operating condition shall be installed. The mirror locations shall not create a safety hazard for the operator or passengers. The mirrors shall be adjustable to give the operator full view of required area. Adequate reinforcing shall be provided to dampen vibrations.

- **Rearview Mirror** - shall be mounted ahead of and above the operator's position to provide a general view of the interior of the bus. Mirror shall be a rectangular/convex design.

- **Relay Mirror** - shall be installed at the upper right hand corner of the windshield header panel and be of suitable size to provide the operator a view of the rear door exit step mirror.

- **Entrance Door** - diminishing-type mirror shall be mounted over the front door to provide the operator with a view of the front vestibule area when passengers directly block the operator’s view.

- **Rear Door Mirror** - shall be installed at the rear of the exit door so as to provide the operator a view of the rear exit step by looking in the relay mirror mounted on the windshield header panel.

- **Bicycle Rack Mirror** - shall be installed on the front header panel. The mirror shall be permit the operator to view the Bicycle rack equipment.

**TS 9.7 Windows**

**TS 9.7.1 General**
Buses will not be equipped with back windows.

**TS 9.7.2 Windshield**
The windshield shall be a single (1) or a two (2) piece, street side and curbside windshield, fitted with a vertically mounted center divider, capable of sealing and holding both windshields fixed securely. As applicable, the replacement of either windshield (two-piece system) shall be accomplished without removal of the other windshield.

The windshield shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. Two sets of eyes shall be used, one for the 95th percentile male and one for the 5th percentile female. The location of the seat H points and eyellipse center points shall be determined using individual people matching the profiles above and they shall be seated in a normal driving position. Implicit to this requirement is that
any set of eyes between the upper and lower eyellipse shall also meet the requirements of SAE J1050. The vertically upward view shall be a minimum of 15 degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3-1/2 feet high no more than 2 feet in front of the bus. The horizontal view shall be a minimum of 90 degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90-degree requirement, provided that the divider does not exceed a 3-degree angle in the operator's field of view. Windshield pillars shall not exceed 10 degrees of binocular obscuration.

The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus. When the bus is operated at night with the passenger interior lighting on, essentially no reflections shall be visible in the windshield immediately forward of the operator's barrier. Reflections in the remainder of the windshield shall be minimized, and no reflection of any part of the bus interior behind the operator's barrier shall be visible in the windshield.

The windshield shall be easily replaceable by removing zip-locks from the dry seal windshield retaining moldings. Bonded-in-place windshield shall not be used. The windshield glazing material shall have a 1/4-inch or 6-mm nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673. The glazing material shall have single density tint. The upper portion of the windshield above the operator's field of view shall have a dark, shaded band with a minimum luminous transmittance of 6 percent when tested in accordance to ASTM D-1003. Boundaries of the shaded band shall extend to legal limits and comply with the operator’s field of view requirements.

The front destination sign glass shall be AS rated thick safety glass. The glass shall be retained with a dry seal, "zip lock" gasket. The glazing shall be masked on the inside in a manner that will allow a view of the sign only.

**TS 9.7.3 Operator’s Side Window**

The operator's side window shall open a minimum of 10-inches. This window section shall slide rearward in tracks or channels designed to last the service life of the bus. The operator's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall have a single density tint.

The operator’s window shall be non-locking and shall be designed to preclude opening or closing caused by acceleration or braking of the bus. The operator's window shall be equipped with pull handles on the inside and outside positions. The sash frame, lower rail shall be designed to drain water to the exterior of the bus.

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

The upper portion of the operator’s window, above the operator’s field of view, shall have a dark, tint-band. This band shall have a minimum luminous transmittance of 6 percent when tested in accordance to ASTM D-1003.

**TS 9.7.4 Side Windows**

**TS 9.7.4.1 Configuration**

Windows shall extend from the shoulder height of a 5th percentile, seated, female passenger to the eye level of a 90th percentile, standing male passenger. Vertical mullions between windows including the trim shall not exceed 12 inches in width. The window mullion width in the low to high floor transition area may be up to 20 inches.
All side windows 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.

The side windows shall be stationary and identical as far as practicable, throughout the vehicle.

The windows shall be designed and constructed to enable a 3M mechanic to remove and replace the glazing of any side window in less than 3-minutes using common hand tools. Glazing in the window assembly shall be replaced without removal of the window from its installed position. The exterior glazing shall be held in place by mechanical brackets. The mechanical brackets shall act as part of the structure of the window and hold in place a 1/16 inch or 1/8 inch clear acrylic sacrificial liner. The sacrificial liner must be replaceable in 2-minutes or less. The sacrificial liner must be replaceable without removing the glazing from the sash, without removal or manipulation of the window assembly’s rubber molding and shall not require the removal or modification of any other parts or fasteners.

The window shall be fully serviceable immediately following replacement of the glazing. The quick-change method shall be tamper resistant.

Upon request, the Contractor will demonstrate that the listed replacement time for passenger windows is achievable. Contractor will provide window replacement time with Proposal.

**TS 9.7.4.2 Materials**

Side glazing material shall be ¼-inch nominal thickness laminated safety glass and shall conform to the requirements of ANSI Z26.1, FMVSS 205 and the Recommended practices defined in SAE J673. The maximum solar energy transmittance is not to exceed 40 to 50% and the luminous transmittance shall be no less than 25%. Glazing over destination signs shall be untinted.

All glazing material aft of the standee line shall be equipped with a clear acrylic sacrificial liner that shall be easily removable in the event of vandalism. The acrylic material shall be clear and shall have a minimal effect on the transmittance of the underlying glazing. This acrylic material shall not be adversely affected by ultra-violet rays and shall withstand normal cleaning practices. The liner shall be vented to prevent the accumulation of moisture between it and the glazing. The sacrificial liner shall not drum, chafe or contact the window glazing. A 3M mechanic, without the use of any specialized tool(s), shall be able to easily remove and replace the acrylic liner in 2-minutes or less, Transit Care® or equal.

Engineering drawings showing the design and dimensions of all side window frames and glazing shall be submitted to SEPTA by the Contractor before the tenth bus is delivered to SEPTA.

The sash shall be anodized or powder coated aluminum and black in color. A rubber seal attached to the window frame shall achieve weather sealing. The sash construction shall be such that the sash drains will prevent the entrance or backup of water into the bus.

All unobstructed side windows shall meet the requirements of FMVSS No. 217: Bus window retention and release. Sash shall be provided with an emergency push-out feature that shall be designed for quick resetting by the operator while the bus is in service. The windows shall be hinged and captive and shall not fall out after being pushed out. The high-force application which is straight perpendicular to window surface as described in FMVSS No. 217, shall have a magnitude between 30 and 60 pounds. In addition, the sash frame shall be installed with a retaining feature which will prevent the sash frame from being released until it is intentionally pushed out. It shall also be equipped
with a positive lock device that must be manually released before the window can be pushed out. This device shall be of a sturdy design, not prone to breakage by mishandling.

An "Emergency Push-out" instruction plate shall be furnished and installed at each window.

Windows on the bus sides and in the rear door shall be tinted a neutral color, complementary to the bus exterior. The maximum solar energy transmittance shall not exceed 40 to 50%, as measured by ASTM E-424, and the luminous transmittance shall be no less than 25 percent as measured by ASTM D-1003. Windows over the destination signs shall not be tinted.

**TS 9.7.4.2.1 Water Test**

All coaches, after manufacture and before shipment, shall be tested to check for water leaks in the roof and body sheets, windshields, doors, windows, under floor and sash in the presence of the Resident Inspector. The bus shall be complete and ready for service-all equipment installed and functional. Any SEPTA inspector may refuse to accept a Contractor vehicle for water test if in their sole judgment the vehicle is incomplete or otherwise deemed unfit for water test. All coaches shall be tested and certified as “leak free” by the Vehicle Manufacturer Quality Assurance Representative prior to presentation to the Resident Inspector for water test. No coach shall be presented to the Resident Inspector for Final Inspection without satisfactory completion of SEPTA water test. Water shall be sprayed from nozzles which are spaced no more than 1-3 feet from and aimed directly at the aforesaid areas. No less than 0.5 gal/min shall be delivered per square foot of surface being tested and the nozzle velocity of the water shall not be less than 80 ft/sec. **The duration of the water test shall be 25 minutes.** The water test procedure must be approved by SEPTA prior to the start of bus construction. If water leaks are found on buses delivered to SEPTA during this procurement, the Contractor shall be required to water test each bus until all leaks are identified and repaired. Alternate methods of testing for water leaks shall be considered by SEPTA if it can be demonstrated, to SEPTA’s sole satisfaction, that delivery to SEPTA of a leak-free bus is ensured. SEPTA inspectors may indicate to the Contractor what utilities, e.g., HVAC system operation, are to be in operation and other general conditions of test on a test by test basis. The Contractor is instructed that omissions or alteration in procedure or methods of or by individual property inspectors, do not regulate, subordinate or obligate other inspector’s regimes in testing. The Contractor shall issue a form with every water test indicating the source area of and remediation for, the repaired leak(s). Any leaks occurring to roof front, intermediate and/or rear roof cap(s) cableway/wire-ways, seams, mounting or equipment facilitation penetrations and/or affixed structures may at the sole discretion of resident SEPTA inspector cause the complete removal of the aforementioned articles and attendant structural and/or fixed equipment.

**TS 9.8. Heating Ventilating and Electric Air Conditioning**

The electric HVAC shall be roof-mounted. The electric HVAC unit shall incorporate multiple staged or multiple unit full hermetic compressors whereby the compressor and electric motor are packaged essentially inside of a common container (can) whereby no rotary shaft seals, gaskets or like shall exist. The electric compressor motor(s) shall be cooled by suction gas, thermally protected, inverter rated and mechanically arranged to provide reliable service coincident to the basic vehicle life.

All system piping shall be hard soldered fittings except the refrigerant dyer which shall utilize ORS fittings designed to permit lateral release from the liquid line pipe work and where defined by § TS 9.8.1 Capacity and Performance.

In any area of specification or APTA recommended procedures, SEPTA’s specification extant and/or as contemporaneously clarified, shall be the determining authority of requirement, procedure and acceptance of fitness of application of HVAC equipment under the control of this specification and contract.
All required system controller(s) and (low voltage) inverter(s) shall be located inside the evaporator housing-no electronic component other than condenser motors shall be exposed to exterior pollution. All through power studs shall be cast in place (non-floating stud) type. All medium voltage poly-phase power supply terminating means shall be installed in conspicuously and labeled dedicated interlock protected junction box(es).

**TS 9.8.1 Capacity, Performance and Maintenance**

The climate control system shall maintain the interior of the vehicle at a level suitable for climatologically normal conditions found in the continental United States and as specified herein. The heating, ventilating, and cooling systems shall maintain an average passenger and operator area temperature of 68 degrees F for air conditioning and 72 degrees F for heating at relative humidity’s of between 30 % and 50 %. The system shall maintain these conditions in ambient temperatures of between 5 to 110 degrees F with humidity’s between 30% and 50%. The interior temperature shall not vary more than 3° F at any interior measurement point on the vehicle under no door operating conditions.

Replaceable Filter(s)-Maintenance

Air Intake Filtration-Filters shall be passive electrostatic, arranged to prevent plugged lifting, while affording easy removal and replacement.

Refrigerant Filter Dryer-shall be arranged to permit decoupled release using slip nut (ORS) fitting that prevent any compression or distension of the liquid line.

The filter dryer line and programmed pump down routine shall permit full isolation of system for removal and exchange of the dryer housing at a minimum 4 service year frequency.

The HVAC system shall be designed to maintain the aforementioned interior temperature(s) at all operating profiles. The refrigerant used in the system shall be R-407c.

The system shall inherently provide by design, material usage and applied practices provide a system that retains refrigerant, maintains operational integrity, and provides the highest degree of energy efficiency. Vibration isolation means shall be incorporated in order to prevent noise or other vibratory forces that can be sensed or would otherwise degrade passenger comfort. The system pipe arrangement shall avoid hoses, gaskets or like equipment in the refrigerant loop. The refrigerant compressor(s) shall be designed and arranged for service to fully integrate with the propulsion supplier’s power inverter in a way that ensures the highest reliability and lowest operating costs.

Condensate drains shall be clear reinforced nylon tubing arranged to ensure positive drainage and proper sanitation of the evaporator collection pans and lines. All exit lines shall be rubber type valve protected. Line routing shall preclude dips or other deployments that would trap condensate from properly draining.

**TS 9.8.1.1 Electrical Connectors, Interface and Inverter Requirements**

The HVAC unit shall be equipped with a HVIL protected terminal box.

a.) Contactor-an HVIL control shall be provided. The contactor shall be mounted in an enclosure suitable to water spray and pressure wash. The contactor shall indicate line (indication lamp) side power if present when inverter supplies said condition. If, where the contactor is remotely mounted from the motor a means of line voltage indication shall be arranged for at the compressor module.

b.) There shall be a manual disconnect means with a lock out for safety.
TS 9.8.1.1 Inverter and Converter Physical Arrangement and Cabling Requirements
Inverter(s) inputs shall be connected to the HVDC battery (ESS) at a roof mounted dedicated water proof junction box. Proper fusing, load current monitoring and circuit protection cutout shall be arranged at the junction box. The junction box shall be fitted with color coded cables (orange for HVDC) with water tight entrance and exit bushings. All circuits shall be labeled and suitably protected from environmental degradation. All cabling, wireways and devices shall be logically routed and supported in order to ensure proper performance and personnel safety.

The converter/inverter and attendant junction and/or equipment boxes shall be equipped with HVIL (high voltage interlock) switches applied to preclude unintended exposure of high voltage direct current to maintainers.

The low voltage direct current (LVDC) output cabling shall be suitably and properly physically isolated and electrically protected.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements as specified in Section TS 5.21.1.

TS 9.8.1.2 Motor Performance
The motors supplied for the operator's heat and ventilation, defroster and any auxiliary motors shall be an electrically commutated brushless DC (ECDC) low voltage synchronous motors with a MTTF of 40,000 hours. The motor and air delivery system shall be completely maintenance free during that period. All motor(s) shall be readily accessible for repair/replacement with no special tools at a MTTR of 0.25 hours maximum. Potted modules shall not be located in the HVAC or auxiliary system’s re-circulated air path. Potted modules shall be electronically and mechanically configured to preclude thermal overheat failures. The modules shall incorporate an integral overheat failure trip indication device that operates coincidentally with the logic motor failure system.

TS 9.8.1.3 Door Operation Cycle
At an initial interior temperature of 70 degrees F and at an ambient temperature of 0 degrees F, zero wind velocity, with the operator’s heating system on and the vehicle at operating temperatures the interior temperature of the vehicle shall not drop below 68 degrees F with the front door open for 10 seconds out of every 2 minutes. The temperature shall be measured before the door opening cycle. At that time, the maximum temperature differential between any two (2) points in the defined interior volume shall not exceed 4 degrees F. Test duration shall be 10 operating cycles.

TS 9.8.1.4 Boost Pump
A circulating pump shall be provided if required to ensure proper operation of all HVAC and auxiliary heat and defrost functions. The circulating pump shall be a Brushless, seal-less type, using an ECDC motor. The pump shall operate at 24 volts DC nominal and shall be designed to perform for the expected life of the vehicle. The pump, engine, HVAC unit, auxiliary heater, defroster, operator’s heater and Floor/Stepwell heaters, if equipped, shall incorporate isolation valves.

TS 9.8.1.5 Production Checks
Provisions shall be made to check the HVAC system on each vehicle. The Contractor shall supply, as required by the applicable Quality Assurance sections of this specification, a complete and detailed production test procedure for the system installed before delivery of the PILOT INSPECTION Vehicle.

**TS 9.8.1.6 HVAC Performance Test**

No test(ing) shall be considered as contractually valid and enforce whereby testing is conducted in advance of test plan and scope of work as defined herein by this specification.

All HVAC system testing shall meet the requirements where specified herein and where SEPTA directs the use of (APTA) American Public Transportation Association, “Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning Systems. Contractor may obtain copies of the practice from APTA. A test plan shall be delivered to SEPTA by the Contractor. Testing shall be reviewed and approved by SEPTA thirty (30) days in advance of the Contractor’s scheduled test. Testing must be done on the SEPTA PILOT INSPECTION VEHICLE. SEPTA may, at their option, be present during the HVAC test.

For all tests, the Contractor shall present a scope of work including a schedule of tests, facilities readiness and check sheet(s) and all other documents indicating affirmatively and completely that the HVAC test Contractor is ready to perform all work scheduled in accordance to the prior submitted and accepted test plan.

**TS 9.8.1.7 Instrumentation**

The Contractor shall employ the instrumentation set up and practice as defined by this specification and the APTA recommended practice “Bus Air Conditioning Instrumentation for Performance Testing”, section for sensor positioning, minimum sensor locations, Temperature Measurement-Methods, Locations and Averaging. The Contractor shall apply all other sections as applicable. The minimum number of sensor location points for data acquisition shall be 84 locations.

**TS 9.8.1.8 µa Factor Test**

The Contractor shall perform this test in accordance with the APTA procedure. The µa factor test shall be performed as the first test conducted in the HVAC performance Test series.

**TS 9.8.1.9 Air Conditioning Pull-down Test**

The capacity of the air conditioning system shall meet all criteria of the “Modified Houston Pull-down Method” as described in the APTA recommended practice. The pass criteria for this test shall be as described in Section 8.4.6 of the APTA document and modified by SEPTA as; a pull-down or lowering of temperature of the vehicle interior space from 100 degrees F to 75° in 38 minutes from start. All six (6) critical test measurement thermocouples must be 75° in 38 minutes” (not an average).

At all other test points as referenced § TS 9.8.1.7 Instrumentation, the temperature shall not vary more the 3° F at any measure point. The operator shall by proper arrangement of equipment be inherently equal to the best performing heated and cooled (conditioned) air available from the HVAC system. The operators area ducting shall supply conditioned air not vary more than 1° F from the coldest in AC mode, and the warmest in heating mode ducting outlet temperature.

During the testing phase, wayside power supplies may be employed of a capacity not to exceed the basic vehicle installed capacity.

**TS 9.8.1.10 Heat Capacity Test**
The Contractor shall set up heating tests in accordance with the SEPTA specified requirements and APTA specifications using a combination of “In-House and “On-Road” methods as described in APTA guideline Section 9.1.3-A and B and where modified by SEPTA’s specification. Flow-rates and temperature(s) shall be measured values not calculations. The Contractor shall submit in writing their test plan based on the specific requirements of this specification and the test procedure outlined by the APTA Heating Tests section, subject to the criteria of same. Test plans shall be 30 working days in advance of scheduled testing at the Contractor’s or elected site. The Contractor or their subcontractor or HVAC system supplier shall determine all affected glycol loop flow rates from on road CBD average measurements. For heating test purposes, a wayside glycol loop generator shall be utilized.

The glycol loop temperature for all testing shall not exceed 170°F inlet.
The Contractor shall record all inlet and outlet temperature Δ temperatures of all installed heating cores in order to ensure effective and balanced utilization of equipment.

**TS 9.8.1.11 Performance Requirement**

The electronic control system shall provide total all season, seasonal dependent set point control and soft/hard system fault indication identification and data archive. The system shall be programmable through Contractor-supplied software and addressable through Contractor-supplied tools and/or resident to equipment. The system shall incorporate through transducers and sensors, microprocessor control, and software configured tables the ability to detect and protect against modes of operation that would cause damage to the system at any operating profile or mode, up to and including system shut down. The system, either through resident means or export ability shall provide indication and storage of operating and failure modes and shall have the capability to export those through J-1939 message format. All user identified fault codes shall be time and date stamped. All load switching shall be “solid state” contactor-less systems. The system shall include integral compound gauges located in the return air portion of unit.

The HVAC controller shall transact necessary specification CAN and other data as required herein, as specified in general requirements of this document and as required to affect the vehicle systems integration as a whole.

The temperature control set-point for the system in the cooling mode shall be 68 °F and 72 °F in the heating mode. Temperature variance (control) shall not be greater than ± 1° F in all operating modes.

The operator shall have full control over the defroster and operator's heater. The driver shall be able to adjust the temperature in his 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 where interior temperature rise or values over ambient exists.

Interior temperature distribution shall be uniform to prevent hot and/or cold spots. After stabilization with doors closed, the temperatures between any two points in the same vertical plane in the passenger compartment, from 6 inches to 72 inches above the floor, shall not vary by more than 3°F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than 3°F, from the front to the rear, from the average temperature determined in accordance to APTA Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System. Variations of greater than 3° F may be allowed for limited, localized areas provided the ninety five (95%) of the measured temperatures fall within the specified requirement. The aforementioned allowance does not apply to the operators area. Any variation shall be disclosed and requested in writing to SEPTA. SEPTA may at their sole discretion permit the variance.
Summary:
Temperature shall not vary more than 2° F in all 3 measured x, y planes.
Temperature Shall not vary more than 4° F from any z plane.

**TS 9.8.1.12 HVAC Test Report**
A report indicating test scope and purpose, test methods (conformed), result shall be tendered and delivered to SEPTA’s representative and where defined herein.

**TS 9.8.1.13 Software, Tools And Equipment**
Refer to Attachments Section TS 11.3.1-5: Technical Specification.

**TS 9.8.1.13 Sensors and Maintenance**

**TS 9.8.13.1 Hoses Suction/Discharge and Miscellaneous**
There shall be no hoses or like equipments deployed or utilized by this HVAC unit. Pressure and thermal sensors and like equipments shall be mounted to fixed termination points via engineered hardware. Sensor range shall be suitably compensated and applied for the application conditions of service. Sensors shall warn of anomalous conditions without undue false indication.
All pressure and temperature sensors shall be marked and properly fitted and field replaceable without un-soldering. All return air and sensors arranged for floor heating control shall report to a single common control point that shall supervise and control all HVAC functions. All controlled functions shall be as result of the single control processing and that shall be the fully engineered controller provided by the HVAC sub supplier. All sensors shall be autonomously mounted and not affixed to seating, seating structure, grab rails or other removable interior bus components.

**TS 9.8.13.2 Charging Ports**
Charging and evacuation ports shall be fitted and arranged for maintenance, lawful preservation of refrigerant and unit replacements. The controller shall provide a pump-down and evacuation mode of operation. The mode when activated shall re-program necessary sensor and temperature values required by mode of operation. Pump-down routines shall be programmed into the basic system control whereby refrigerant displacement is facilitated by programmed sensor over-rule.

**TS 9.8.2 Controls and Temperature Uniformity**
The operator shall control the enabling function for the climate control system. All other functions shall be fully automatic. All climate control routines and change-over functions shall occur without any operator requirement or supervision.

All controls and function switches shall be properly visible under all operating conditions using only SEPTA approved graphical icons and/or labels.

**TS 9.8.2.1 Function Indications**
The following states of operation shall be defined and displayed at these locations.
FUNCTION
1. AC Fail
2. All other status indications

LOCATION
Front dash and Message Display Terminals
At unit status panel

TS 9.8.3 Air Flow

TS 9.8.3.1 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 percent of the seated load. Airflow shall be evenly distributed throughout the bus with air velocity not exceeding 100 feet per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

Airflow may be reduced to 15 cfm per passenger (150 percent of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure at least 70°F air outlet temperature. The heating air outlet temperature shall not exceed 120°F under any normal operating conditions.

Upon the HVAC controller recognizing sustained velocity for some definite time period and interior temperature stabilized for a time period, then the system shall open a fresh air door facilitating the import of some volume of fresh air to the cabin space.

TS 9.8.3.1.1 HVAC Ducting

Ducting shall be a smooth bore fully enclosed system. The HVAC ducting system shall be a system whereby conditioned air is conducted from a source to delivery insuring minimum change in temperature and flow. The conservation of flow efficiency requires ducting as installed and arranged to buses defined by this specification to be complete, fully confined, non-shared structures. Ducting shall be arranged when shared with other utility spaces as a separately budgeted space and ducting shall minimize pressure losses while ensuring best laminar flow practice. Objects, devices or structure shall reside outside and not shared in the interior space of HVAC ducting as defined herein. The interior ducting space shall be fully and exclusively arranged for the flow of conditioned air. The ducting shall be a fabric or like back structure and the base light panel(s). Ducting shall be 95% volumetrically identical and therefore essentially bilateral, mirrored image structures throughout the bus.

TS 9.8.3.2 Operator's Area

TS 9.8.3.2.1 Operator's Area Defrost Function

The vehicle's defroster system shall meet or exceed the minimum requirements as defined by the SAE J-382 practice. Test procedure shall be SAE J-381. The defroster shall fully clear the windshield as specified without wiper operation until the final two minutes or at one wipe operation per minute from commencement of test. The test coolant temperature shall be 165°F at the flow rate measured from the road test conducted to the bus under test. For testing purposes, the bus may operate from a glycol loop at the conditions described herein.

If a cable-operated system is proposed for mode door control, the system shall have a cable and conduit assembly of sufficient quality to last the life of the vehicle. The aforementioned cable and conduit provision applies to all cable and conduit systems supplied for remote control actuation functions. A three (3) speed fan shall be provided.
TS 9.8.3.2.2 Operator's Area Climate Control
The operator’s area shall be equipped with a separately adjustable, multi-speed, forced air distribution system. The fan motor and cage shall be remotely located in an area that allows the efficient acquisition of treated air and delivery of that air flow to the operator without an increase in temperature of greater than 1°F from point of acquisition to point of delivery, as referenced by the air temperature measured at the HVAC unit outlet. The location of the motor and cage shall be readily accessible for repair with no special tools, and shall have a MTTR of 0.5 hours max. A separate floor heater shall be provided for the operator. The operator’s floor heater shall deliver adjustable heated and flow controlled air to the operator’s foot and leg areas, left, right, and center. SEPTA may allow the Contractor to integrate the operator's heater and defrost functions, provided that the Contractor can demonstrate undiminished performance with that practice. The operator’s area climate control outlets, with systems operating at maximum output, and all area systems on, shall not generate a noise level greater than 75 dBA as measured from the head projection area coincident to the 5th percentile female to the 95th percentile male operator. The Contractor shall conduct testing at the PILOT INSPECTION and provide a report to the site inspector.

TS 9.8.4 Air Filtration

TS 9.8.4.1 Air Intake Systems
All air intake systems shall be sufficiently integrated into the vehicles as not to require any special maintenance attention for the life of the vehicle. If filter(s) are supplied, they shall be integrated in a manner that ensures efficient and reliable operation and ease of maintenance. The air intake system shall not allow water and/or debris to lodge in, or collect near any intake or discharge area. The system shall be designed in a manner that precludes any foreign material from collecting on coils, heat exchangers, ducts or plenums. The structures constituting HVAC housings, ducts and hardware shall not rust and/or corrode for the life of the vehicle. Filter retention system shall preclude lifting of the filter media during operation up to and including clogged filter condition.

TS 9.8.4.2 Air Filter Capacity
Outside air openings for air intake shall be located to ensure cleanliness of air entering the climate control system, particularly with respect to engine exhaust emissions from the vehicle itself and other vehicle sources. All intake openings shall be designed to prevent the entrance of water, dirt, debris and other foreign material. Air filters shall be of disposable passive electrostatic type.

Outside air shall be filtered before discharge into the passenger compartment. The filter shall meet the ASHRAE requirement for 5% or better atmospheric dust efficiency, 50% weight resistance, and a minimum dust holding of capacity of 120 grams per 1,000 cfm cell. The filters shall be easily removable. The filters shall be designed to ensure proper operation of the HVAC system at service intervals of between 3,000 to 6,000 miles. Condensate drains shall be provided that shall remove all collected condensate from air handling areas. The drainage system shall not clog from the condensate collected, or from road dirt. Condensate piping shall be arranged to be self-clearing. Condensate piping shall be ridged copper piping, suitably clamped and anti-chafed and piping shall be routed for positive gravitational drainage. The Contractor shall provide their transition duct(s), air return grill and housing, filter retention system plans and drawings, prior to Pilot Inspection.

TS 9.8.5 Roof Ventilators
One or two (if not obstructed by roof equipment two shall be provided) 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.
The rear roof ventilator/escape hatch requirement may be deleted if the installation of said component precludes the mounting of roof mounted equipment required by this specification.

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. Ventilator shall cover an opening area no less than 425 square inches and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 inches, or with all four edges raised simultaneously to a height of no less than 3-1/2 inches. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) shall be sealed to prevent entry of water when closed.

**TS 9.8.6 Maintainability**

All HVAC units shall incorporate a diagnostic and function control panel. For maintenance purposes, the panel shall permit full manual operation of the HVAC unit. The first power up cycle shall reset all automatic operation. The panel shall incorporate/gateway all diagnostic routines and test functions required to attain proper system operation during shop level repairs. No PC based external software shall be required to attain shop level maintenance. No reconfiguration of certain system settings or historical data shall be attainable or erasable at the diagnostic and function panel. All indication lamps and/or displays shall be solid state (LED).

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 utilizing O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shut-off valves may be provided in lieu of self-sealing couplings.

The condenser shall be located to efficiently transfer heat to the atmosphere, and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or to discharge air into any other system of the bus. HVAC components located within 6 inches of floor level shall be constructed to preclude damage and corrosion.

**TS 9.8.6.1 Motors and Blowers**

The supplied motors shall be maintenance free for the expected life of the coach with a minimum 40,000 MTTF. All motors defined by this section shall be replaceable at 0.25 hours MTTR. All wiring shall be modular and polarity protected. All fan cages shall be removable without force that would tend to distort or damage the cage so as to prevent reuse. Serial numbers or modification identifications shall be viewable without removal of units, motors, blowers, motor modules for verification.

The HVAC manufacturer shall supply documentation for the motor maintenance package consisting of the following items: These items are due at PILOT INSPECTION.

1. Test data indicating life cycle testing-application specific.
2. Complete schematic diagrams for motor inverter and/or drive.

**TS 9.8.6.2 Electronic Controls-Environmental**

All electronic control boards shall be located in an area that permits pressure washing/cleaning of heating, evaporator and condenser coils without contaminating or damaging any electronic component in the HVAC system. If electronic components are located in the evaporator and/or the condenser area, the components and wiring must be “weather packed” and/or removable in 0.1 hours MTTR. The electronic control system may be remotely placed in order to meet the aforementioned requirements of this section. The electronic control system shall not exceed 0.25 hours MTTR. If circuit boards employing indication require maintainer’s attention, then said indication shall be readily visible and shall not be obstructed by other equipment. If the electronic control system employs an external communication means then the connection point shall be readily accessible and sealed when not in use. The control module shall be Thermo-King InelligAIRE III.
The I-3 controller shall provide all HVAC control as well as provide all specification required power management and data sourcing and conveyance functions.

**TS 9.8.7 Entrance Heating**
Heat shall be supplied to the entrance area to prevent accumulation of snow, ice, or slush with bus operating under design operating profile and corresponding door opening cycle.

**TS 9.8.8 Floor Level Heating**
Sufficient floor level heaters shall be provided that evenly supply heated forced air through floor ducts across the length of bus. The housing shall be stainless steel with a durable and attractive exterior surface. Floor ducts may be discontinued at the upper level but additional provisions to prevent cold floor and ensure temperature uniformity shall be included. Floor heater(s) may be used instead of floor ducts to ensure temperature uniformity. If floor heater(s) are used the housings must be constructed of corrosion resistant stainless steel. Control of the floor level heating shall be through the main HVAC system electronic control. All heaters shall be installed above floor level, arranged for interior servicing and no housings or other system elements shall be exposed to the vehicle exterior. All coolant isolation valves and solenoid valves, motors and terminal boards shall be accessible without removal of other equipment from the interior of the coach. Isolation valves maybe arranged externally as approved by SEPTA.

**TS 9.8.9 Auxiliary Heater**
The Proposer shall submit two (2) qualified component suppliers. Each supplier shall have obtained 10,000 units installed during the previous ten years.
SEPTA shall require an auxiliary heater to be supplied as part of this Contract-if and where indicated from testing or at SEPTA’s sole judgment regardless of test result. This section shall outline the salient features and performance requirements for an auxiliary heater. The unit shall be mounted in an area that permits ease of removal and maintenance. The unit shall be completely modular as to fuel, coolant and electrical connections. The Contractor shall provide coolant isolation valves. The heater unit's exhaust pipe shall be routed to the rear edge or street side rear of the vehicle. The auxiliary heater tail pipe shall not encroach or diminish the vehicle departure angle.

The Contractor shall make a report of finding from test indicating whether or not an auxiliary heater is required for supplemental heating upon consideration of the propulsion system applied, the pull up testing and operational diversity factors specified throughout this specification.

If from SEPTA’s sole determination no auxiliary heating would be required, the Contractor shall fully provision for the auxiliary heater installation. All brackets, hydraulic pipes and fittings (looped through/but valve isolated), intakes and exhaust systems brackets, all electrical hard-wiring, plugs cables, (with termination covers) multiplex programming provision, necessary diagnostic software and third 3rd party reporting.

**TS 9.8.9.1 Capacity/Performance Requirement**
The basic capacity shall be determined by the expected duty cycle of the unit. The Contractor shall submit their estimates and documentation outlining the basis for heater selection. SEPTA may select a heater submitted by the Contractor or a heater judged to be in the overall best interest of SEPTA. The unit shall have a self-check/test routine capability and shall be configured to export control and fault data through a J-1939 data link.

**TS 9.8.9.2 Vehicle Interface and Performance Features**
The heater unit shall incorporate these basic vehicle interfaces:
The auxiliary heater shall operate co-incident to the operation of the vehicle Day/Night run mode. There shall be no driver operated or controlled switch.

Data link platform that allows the unit to be enabled via Computer/Aided/Radio/Dispatch (CARD) system. J-1939.

Unit status, ready/operating/inoperative transmitted to the CARD system.

**System Fault Log:** The unit shall record and maintain an exportable data log for customer down load. The heater unit shall export data as follows to 3rd party devices as follows:

1) Unit operating mode.
2) Coolant overheat.
3) Voltage, hi-low.
4) System fault.
5) Failed starts

**TS 9.8.9.3 Thermal Performance**

The heater unit shall be arranged to supply heated coolant to the engine in a manner that permits economy of use and proper coolant flow. The input to output pipe temperature shall be no greater than 10 - 12 degrees F, measured at the heater unit. The unit shall be arranged to supply heated coolant to the engine, and the status of auxiliary coolant system devices shall not affect or degrade the heater's performance in this regard. Performance verification shall be at the PILOT INSPECTION.

**TS 9.8.9.4 Tools And Software**

Refer to Attachments Section TS 11.3.1: Technical Specification.

**TS 9.9 Signage and Communication**

This section describes the on-board signage and communication system to be furnished by the Contractor that will provide for an Automatic Stop Announcement System (ASAS) and will function with the Computer Aided Radio Dispatch (CARD) System installed at SEPTA’s Control Center. The on-board equipment for the communication system shall be configured to provide all specified functions that include:

- all stop and next stop announcements
- voice communications
- two way text communication
- automatic vehicle location (AVL)
- automatic vehicle monitoring (AVM)
- route and schedule adherence
- covert microphone and emergency switch

**TS 9.9.1 Exterior Route Displays**

**TS 9.9.1.1 Destination Signs**

The destination sign system shall be provided from Hanover Displays as follows:

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OL028N32</td>
<td>160 17 Front Sign</td>
</tr>
<tr>
<td>OL054USN32</td>
<td>112 x 15 Side Sign</td>
</tr>
</tbody>
</table>
An automatic electronic destination sign system shall be furnished on the front, on the right side near the front door, and on the rear of the vehicle. Display areas of destination signs shall be clearly visible in direct sunlight and/or at night. The sign system shall provide optimum visibility of the message display units for passengers and shall meet applicable ADA requirements defined in 49 CFR, Part 38.39. The sign modules lighting shall be Light Emitting Diode and shall not require major disassembly of the sign unit(s). Destination signs shall be installed in such a manner as to facilitate easy access for replacement of the entire sign assembly, or components such as LED’s and electronic control modules, from inside the bus within 60 minutes by a 3M mechanic. Lamps and associated parts shall be commercially available. All signs, excepting rear number sign shall be bracketed and swiveled as to permit full access to glazing for cleaning and maintenance.

The sign(s)/display units shall be warranted for twelve (12) years as applied and arranged in vehicle service.

Destination messages, route designations, and public relations messages shall be independently selectable via a single Operator's Control Unit (OCU) which shall include a display monitor. The rear route number sign shall be controlled by the same OCU that operates the destination signs. The OCU display monitor readout shall show the exact information displayed on the destination signs and route number sign. The OCU shall be located at the interior of the front destination sign access door-header panel. The OCU shall utilize a durable weatherproof keypad with tactile feel for destination message control functions.

The destination sign system shall be capable of programming 10,000 message lines. The number of public relations messages shall be limited only by the remaining number of message lines not used for destination purposes. Sign displays shall have alternating message capability with programmable blanking time between message lines as may be required. Variable blanking times shall be programmable between 0.5 to 25 seconds in duration. Each line message or blanking time for each message shall be individually programmable. The message display units shall incorporate an automatic blanking feature that will cause the display area to blank within 30 seconds of the bus master power switch being turned off.

Destination Sign Programming: The electronic sign system shall be programmable via both an integral connector located in the operator’s area and a wireless LAN. Programming requirements are described more fully in this Section. Software shall be furnished for programming the sign system via an IBM-compatible, laptop computer. Software shall be capable of providing a high degree of flexibility to create, or select preprogrammed, fonts and graphic displays. The sign shall have the capability of being programmed in the field using a PC or field programmer.

The front destination sign shall have no less than 1,792 LED dot pixels, 16 rows by 112 columns, with a message display area of not less than 8 inches high by not less than 56 inches wide.

The side destination sign shall have no less than 560 LED dot pixels, having at least 7 rows and 80 columns with a message display area of not less than 2.7 inches high by not less than 36 inches wide.

The rear route number sign display area shall have no less than 161 LED dot pixels, having at least 7 rows and 23 columns with a message display area of not less than 6.1 inches high by not less than 13.8 inches wide. The sign shall be capable of displaying 4 alphanumeric characters (1 through 9 and A through Z). The rear route number sign shall be located on the rear of the bus, no less than 90 inches above ground in the upper right curbside section.
and shall not encroach upon the rear bulkhead advertising space. The rear route sign requirements of this specification section and § TS 9.9.2.2 may necessitate mounting this unit in an enclosure above the roof line.

The bus “Master Run” switch shall control power to the sign system. The sign system shall be operable in all switch positions except "Off".

The destination sign compartments shall be designed to prevent condensation and entry of moisture and dirt. Additional provisions shall be included, if necessary, to prevent fogging of both destination sign compartment window and glazing on unit itself. Access shall be provided to allow cleaning of inside of destination sign compartment window and unit glazing.

**TS 9.9.1.2 Bus Block Numbers**
The front bus block number sign shall be electronic Light Emitting Diode (LED) type and shall be capable of displaying 4 alphanumeric characters (1 through 9 and A through Z) with an ADA compliant display area. The block numbers to be displayed shall be input directly into the destination sign system’s OCU and shall be independent of any destination sign message code. This sign shall be mounted on the front dash panel toward the curbside and shall not obstruct driver’s view.

**TS 9.9.2 Passenger Information and Advertising**

**TS 9.9.2.1 Interior Displays**
Provisions shall be made on the rear of the operator's barrier for a frame to retain information that is sized 21 inches wide 22 inches high posted by SEPTA, such as routes and schedules. Advertising media 11 inches high and 0.09 inches thick shall be retained near the juncture of the bus ceiling and sidewall throughout the bus. The retainers may be concave and shall support the media without adhesives. The media shall be illuminated by the interior light system.

The Contractor shall provide at least four (4) “schedule” boxes per bus. Schedule boxes shall be designed to accommodate schedule media of the following dimensions:

a.) 4” wide  
b.) 8.25” height  
c.) 1” depth

Schedule boxes shall be brushed stainless steel, aluminum or SEPTA approved equal. Design and location shall be approved by SEPTA.

**TS 9.9.2.1.1 Infotainment System**
The contractor shall provide an infotainment advertising system with full integration into the Intelligent Vehicle System (IVS). There shall be a minimum of two anti-glare, full-color, LCD screens with rugged enclosures and integrated media players appropriately sized for viewing displayed content at all seated positions within the bus. All hardware shall be weather-proof, tamper-proof, and suitable for the transit environment in terms of shock and vibration. Said screens shall have full HD resolution with the capability to auto-dim based on time of day viewing. Screen placements shall be in locations approved by SEPTA.

The system shall provide information on current route status, including anticipated stop arrival times. The infotainment system shall have the capability to provide advertisements, news, weather, real time information, and
other content within a fully customized playlist administered by SEPTA. The system shall be able to accept a wide array of media content file extensions including but not limited to: .MP3, .MP4, .WAV, .JPEG, .JPG, .GIF, .PNG, .WMV, .MPEG, and .SWF. The content playlist shall be fully customizable including order, frequency, timing (peak/off-peak), location specific, sizing and design (screen configuration). Media content shall be delivered via Wifi using the IVS infrastructure, but have the capability to deliver content over the cellular LTE network for service disruption messages and alerts. All media content played shall be logged to the Intelligent Vehicle System and provide usable and configurable reporting to SEPTA including content: time, location, duration, # of passengers present, and frequency. Media content creation and management software shall be made available to SEPTA with at minimum 5 user licenses. The contractor shall price the Infotainment System separately as part of the price proposal in Appendix 2, Item #16-17.

**TS 9.9.2.2 Exterior Displays**

Provisions shall be made to integrate advertising specified by SEPTA into the exterior design of the bus. A maximum number of standard size signs shall be accommodated on the sides and rear of the bus. The exterior advertising media sizes to be accommodated shall be as follows:

- Front Unit-Street side, Below Passenger Windows 30” X 144”
- Front Unit-Curb Side, Below Passenger Windows 30” X 96”
- Rear Unit-Street Side, Below Passenger Windows 30” X 96”
- Rear Unit-Curb Side, Below Passenger Windows 30” X 72”
- Rear Compartment Door* 40” X 86”

The above stated dimensions are the minimum preferred sizes for exterior advertising displays.

*Proposer to provide rear compartment door dimensional drawings with proposal.

**TS 9.9.2.3 Numbering, Signing, Decals**

Monograms, numbers and other special signage specified by SEPTA shall be applied to the inside and outside of the bus. Signs shall be durable and fade, chip, and peel resistant. They may be painted signs, decals, or pressure-sensitive appliqués. At least one permanent sign shall be provided on each side of the bus interior to indicate that seats at the front are priority seats for elderly and handicapped passengers and be in compliance with ADA requirements. Decals on window vandal guards is strictly prohibited. The exact wording; size, color and location for these signs/decals shall be approved by SEPTA. Decal descriptions are included in Attachment to Section TS 11.23: Technical specifications.

**TS 9.9.3 Passenger Stop Request/Exit Signal**

A passenger "Stop Requested" signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37 shall be provided. The system shall consist of a bright yellow colored heavy-duty pull cable, chime, touch-tape and interior sign message. The pull cable shall be located the full length of the bus on the sidewalls and shall be no greater than 63 inches as measured from floor surface. It shall be easily accessible to all passengers, seated or standing. Vertical pull cables shall be provided at each window mullion. Pull cable(s) shall activate a solid state or magnetic proximity switch(es). At each wheelchair parking position a 12" long touch-tape switch shall be mounted vertically on the bottom of the wheelchair flip seats within easy reach of wheelchair bound passengers. The tape switch shall have a connector and be removable without disassembly of the seat. Alternate signal switches shall be considered if equivalency can be demonstrated to SEPTA’s satisfaction.
An auxiliary passenger “Stop Requested” signal(s) shall be installed at the rear door to provide passengers standing in the rear door/exit area convenient means of activating the signal system. The signal shall be a heavy-duty push button type located on modesty panel stanchion immediately forward of and behind the rear door. Button shall be clearly identified as “stop request.”

Exit signals located in the wheelchair parking area shall be no higher than 3 feet above the floor. Instructions shall be provided to clearly indicate function and operation of these signals.

A single "Stop Requested" chime shall sound when the system is first activated. A double chime shall sound when the system is first activated from wheelchair passenger areas.

A "Stop Requested" message shall be illuminated when the passenger "Stop Requested" signal system is activated. The lettering shall be LED, or solid state backlight type. The "Stop Requested" message shall remain visible until one or both passenger doors are opened. The message shall be visible to the seated operator and seated passengers. The operator shall be able to deactivate the signal system from the operator's area.

A door operation indication system shall be provided indicating specific audio and visual door system operation to passengers. The LED lamp system in conjunction with the actual door panels shall be physically arranged as to permit the rear door facing camera system to reliability record door movement and lamp status while maintaining proper indication for passenger(s) in door approach in process of departing from the vehicle. Two multi-function (green/red indicating-single fixture unit) lamps shall be arranged to function as follows:

1.) Upon +2 or -1 set of the 5 position door controller enabled and set indicator lamp from off to flashing green until door panels obtain 85° full open position.
2.) Upon door panels obtaining 85° position lamp shall display solid green.
3.) Upon +2 or -1 unsetting from position at the 5 position door controller to 0 or the transition to other switch points not maintaining last status, switch indicator lamp shall flash red until 5° close limit switch obtained.
4.) Upon door panels obtain of 5° close limit switch the indicator lamp shall be solid red.
5.) The door system indicator shall remain solid red until bus movement is obtained.
6.) Upon rear door opening the internal public address announcement shall indicate “doors are opening”.
7.) Upon rear door opening the internal public address announcement shall indicate “doors are closing”.
8.) Upon any closing operation and upon safety system activation, Vapor Class system and/or sensitive edge switch obstruction detection both door indicating LED’s shall flash a rapid red indication at a rate (frequency) higher than the closing operation indication until said obstruction has cleared and the system no longer detects said event. The system shall indicate to the operator as prescribed § TS 9.5.3.7.
9.) Where the door system is operating from any system purposely set over-rule condition or other circumstance from system control error where the door state is out of logical orderly sequence or condition, the indication lamps shall flash the rapid red sequence as defined by sub§ 8 this section and an announcement shall be broadcast warning passengers not to approach or use the affected doors.

TS 9.9.4 Radio Communication System
The contractor shall supply a radio, Motorola (Septa shall specify) Model. The radio shall be mounted in a secured enclosure in the interior of the bus. The radio shall be housed in the same area as the ASAS, AVM, AVL, and RSA Equipment. A location convenient to the operator shall be provided for the speaker, handset, and cradle. The Contractor shall supply the speaker/cradle/hand set assembly description and part numbers included in attachment to § six (TS 11.27); Technical Specification. Incorporate to the system shall be a Universal Radio Logic Controller (URLC). This device shall enable support to multiple radio transceiver units and the IVN as well as serial, data port 10/100
switching, discreet analog and digital I/O and analog I/O. The device shall process and interface EA functions. The location shall conform to SAE Recommended Practice J287 “Driver Hand Control Reach”.

**TS 9.9.4.1 Radio Antenna Assembly**
The Contractor shall install a low profile, radome covered, unity gain UHF mobile radio antenna with a nominal impedance of fifty (50) ohms on the top exterior surface of the bus. The antenna shall be designed for severe environmental conditions, the antenna mounting and locations to be approved by SEPTA. The antenna radiator shall be made of brass rod material and shall be protected inside an impact, sunlight, and water-resistant radome made from a tough polymer material with a low dielectric constant. The radiating element shall be fed from a (trade type) BNC female connector mounted on the base of the antenna.

The antenna shall be PCTEL ASPC-572 (488-512 MHz). The antenna shall be equipped with a type UHF connector immediately located at the antenna base.

Radio antenna cabling shall be-Times microwave system coax cable model # LMR-240-ma (TESSCO pn. 35065). For the antenna side use UHF male crimp connector from RF industries RFU-508-X TESSCO # 33449 for the end with the radio use a Mini UHF connector from TIMES microwave TC-240-muhf (TESSCO # 95820)

The cable shall be run in conduit to the radio box. An antenna access panel shall be installed in the ceiling, near the centerline, four (4) feet from the end of the bus. The access panel shall be located as close as possible to a structural member to provide a secure mounting base for the antenna, utilizing a tapping plate.

All antennas, radomes and other transceiver units shall be arranged with conduit and covered pull boxes. If said antenna box mounting are located beyond the base lighting access perimeter or space, pull box covers shall be accessible from the ceiling area without removal of any other ceiling panel(s).

**TS 9.9.4.2 Antenna Cable and Conduit**
Antenna cable shall be routed in a conduit or suitable protected means from the roof antenna unit to the radio/equipment location. Conduit shall be equipped with suitable anti-chafe bushing. Conduits shall be delivered with antenna cabling and one additional pull cord installed.

**TS 9.9.4.3 Reserved**

**TS 9.9.4.4 Intelligent Vehicle Systems/Video Surveillance Compartment Cabinet**

**TS 9.9.4.4.1 Compartment Physical Structure and Arrangement of Equipment**
A compartment shall be provided that supports and arranges the layout and connection of all necessary devices, units, and equipment specified to be housed as titled by § TS, 9.9.4.1, 9.9.4.4 and elsewhere in this specification.

The cabinet shall be located in the street side front wheel area. The cabinet shall incorporate all necessary structure and hardware required to affect an autonomous and complete unit. The cabinet shall be provisioned with a 2 hinged or equal door system that facilitates upon opening a minimum reveal of 180° of exposure to equipment. (Front and side facing towards the rear of coach). An emergency escape window shall be provided in order to gain access to a removable rear cover exposing an additional 90° of the cabinet space.

The cabinet door shall be provisioned with a number of appliqués indication by proper placement and orientation wiring demarcation, single line and full wiring schematic, location/descriptions of all equipment located at the affected cabinet.
The cabinet door shall be equipped with an appliqué showing the conformed properly aimed and focused camera JPEG’s, by position, in order to ensure reliable re-aiming during field service.

The cabinet shall be equipped with a means to allow cooling from dedicated ducting to traverse the compartment, cool equipment and discharge under low velocity head to the street side passenger cabin window.

At an interior temperature of 70°F the internal AVM/AVL cabinet temperature shall not exceed the HVAC duct discharge temperature plus a rise of 5°F measured at the cabinet outlet duct, all cabinet enclosed devices operating.

The cabinet shall be arranged with a backplane dedicated to the orderly deployment of wiring that permits sufficient slack for deployment of tray(s) on the inside facing vertical plane and the demarcation termination points for cabling the enters or exits said cabinet.

Internal draft fans (if required) shall not exceed 65dba operating at maximum capacity.

**TS 9.9.4.4.2 Component(s) Layout**

i. Arrangement-All components shall be arranged and mechanically fastened upon draw out platens or laterally arranged platens whereas no other component or wiring harness imposes any restriction or imposition that prevent the components removal. No stacking of units shall be permitted.

ii. Brackets-----All equipment brackets shall be arranged to permit upward and inward (towards the center isle) removal of components.

iii. Tray Lighting-Each tray shall be lighted from the area above from a common switch point installed locally. Lighting shall

iv. Tap and Switch Arrangement-All switches and taps (BNC, data and all other) located in the AVL/M cabinet shall be of the highest quality of their type, labeled and grouped on dedicated plates with permanent embossed or equal labeling.

v. Power Indication, Fuse, Test Points and Switch Layout

All switches, indicator lamps, Fusing and Test Points shall be arranged at the top of the cabinet on an EIA standard plate/terminal box. Switches specified herein and elsewhere that reside in the AVL/M cabinet shall be labeled in accordingly along with the following:

a. All power input mains-LED lamp indication and test points

b. Power indication-open internal fuses indication

c. J1939 CAN loop through cable jumper (two receptacles and jumper) mounted upon plate

d. Camera BNC tap points or equal (tee tapped from harness side back plane)

e. Diagnostic data display terminal and authorizing key switch

**TS 9.9.4.4.3 Compartment Cabling and Raceway(s)**

ii. Cables shall be arranged by schematic connection grouping in trays that ensure orderly routing and deployment.

iii. Cables shall be equipped with color coded tags or bands that identify function grouping of cables by the following:

a. Video system, cameras, camera cabling tap points

b. Network cabling, ID tags identifying backbone and drops

c. Input/output power cabling
d. Vehicle interface cabling

e. All cables shall be arranged with suitable antichafing means.

**TS 9.9.4.4 Compartment Video Surveillance Equipment and Data Ports**

Data ports shall be identified by type on a plate arranged to permit users to properly make connection(s) necessary to tap or intercept said circuits. Where intercept points are required, a jumper shall be provided. The Contractor shall provide all complementary plugs, modified vehicle to PC connectors required to ensure complete functional connectability with all maintenance and engineering operations. Video data taps shall be arranged to permit connection to an NTSC monitor via standard male BNC connectors; they shall be numbered to correlate to the cameras by installed position.

The video surveillance control unit shall be arranged with an input/output, camera cabling and auxiliary connection block that permits the release and removal of the base unit without the disconnection of any terminating point at the unit proper. The base unit shall be arranged with a suitable interposing dongle or connector harness permitting the maintainer to remove said interposing harness from a labeled, keyend termination plate located at the AVL/M cabinet. The labeling of various camera positions and necessary connections shall be conspicuously and permanently labeled at the plate and with the AVL/M door cover appliqués.

**TS 9.9.4.5 Compartment Power Supply Requirement**

The AVL/M, video based surveillance system and fire suppression system shall be maintained across a highly voltage stabilized, power supply. The power supply shall furnish necessary electrical noise filtering (MIL-F-15733), voltage regulation (stabilization) required to operate all affected units.

Compartment Provisioning, Hardware/Racking and Anti-chafing Measures-All cabling shall be group as defined by other applicable sections and herein: All cabling shall be grouped and bundled in logical/logistical order by:

- a. Input/output power
- b. Communication-Radio
- c. Local component to local component-tray to tray
- d. Camera video and power wiring
- e. Can data J1939 network, gateways and suppression
- f. Local switching and ports

All trays and platens shall be equipped with clips or dedicated Delrin™ or equal plastic saddle blocks and Panduit™ on platens or trays that direct and control the deployment of cabling on the tray and cabinet backplane. Where any cable is subject to chafing of any type, there shall be a means to ensure said chafing does not cause damage or degradation to cabling. Cabling equipped with OE molded or built up plugs/receptacles shall not be installed in conduits that prevent their removal for servicing. All other plugs/receptacles OE molded and/or built up shall be placed in suitability apportioned Panduit™ trays were installed on platens or backplanes.

**TS 9.9.5 Public Address System**

A public-address system shall be provided that complies with the ADA requirements of 49 CFR, Part 38.35 and enables the operator to address passengers either inside or outside the bus.

**TS 9.9.5.1 System Speakers –Internal / External**
A minimum of six (6) inside speakers shall broadcast, in a clear tone, announcements that are clearly perceived from all seat positions at approximately the same volume level. The speakers shall be weatherized, non-paper cones and shall be designed to operate up to condensing humidity levels. Speaker grills shall be brushed finished stainless steel, aluminum or SEPTA approved equal. If a separate AGC microphone is required, it shall be integrated into the vehicle ceiling panel(s). A weatherized speaker shall be provided so announcements can be clearly heard by passengers standing outside the bus near the front door. The speaker system shall measure the local ambient noise level and compensate gain accordingly. All speakers and associated PA system components shall have an MTTR of no greater than 0.25 hours to replace. An operator-controlled switch shall select inside or outside or both announcements. A separate volume control shall be provided for the outside system if volume adjustment would otherwise be necessary when switching from inside to outside. The system shall be muted when not in use. All audio wiring shall be properly arranged, supported, and bushed and shall permit re-termination at speaker four (4) times. The audio quality shall be maintained through any operating condition of the vehicle.

**TS 9.9.5.2 Microphone**
A push-button activated, pendant type condenser microphone shall be provided, model subject to SEPTA’s approval. The activation of the normal pre-programmed message format should be at the hardware level at the P.A. amp. A dashboard mounted XLR plug shall be provided, location depending on operator area ergonomics, subject to SEPTA’s approval. A separate P.A. amplifier is not required if the PA function is integrated into another unit of the voice announcement system.

**TS 9.9.5.3 System Amplifier**
The Contractor shall determine the power output and integration (separate system or integrated system) requirements for this hardware. The system shall be an auto-gain, self-compensating type system. Separate systems or an equivalent means shall be provided for internal and external audio.
The AVL system shall produce a reference level tone broadcast to speakers upon request. The 400hz tone shall be set to verify the SPL level(s) in dBa’s at distances established by the Contractor in order to determine the loudness level setting values for the internal, external and evening set back volume levels. The system shall be activated from the destination sign controller by keypad command(s), the level settings shall be displayed in dBa and set point values shall match the loudness levels obtained at the Contractor specified distances.
The Contractor shall supply twelve (12) audio level meters, Extech-407764 or equal.

**TS 9.9.6 On-Board Video Surveillance System**
This section defines the general and specific requirements for the implementation of a video data monitoring system that shall improve the quality of service to our customers. The Contractor shall furnish and install a Digital Technologies International Corp., (DTI) MDR5 based on-board video surveillance system. The video data acquisition system shall monitor and record data acquired from multiple onboard camera sources that shall be arranged to maximize the coverage of the internal activities of SEPTA’s passengers on vehicles in revenue operations.

The Vehicle onboard camera system shall provide the level of video fidelity necessary to monitor the movements of all passengers for which the cameras are arranged. The system in operation shall provide frame rates necessary to avoid latency and/or frame loss that would cause discontinuity of motion and loss of apparent causal circumstance.

All acquired data shall be written, stored and suitably encrypted and said data shall reside on the Vehicle, on a storage system that is designed and applied for the purpose of mobile data acquisition and storage.
The Contractor shall provide drive capacity with the following conditions:

1. System camera capacity-16
2. Frame rate at 15 fps (frames per second)
3. Video resolution, D1 720 x 480 NTSC nom.
4. System hard drive capacity shall, at maximum operating demand, shall store all video and ancillary data for 21 days minimum prior to overwrite, system budgeted for tagged data at 10% of hard drive capacity. The hard drive shall be two (2) terabytes minimum.

All HDD units shall be secured and removable for maintenance and custodial transport.

The system shall integrate and fully support Septa’s current WiMax transceiver 802.16e network. The video contractor shall be responsible for full integration to Septa’s current access points, server system and other necessary infrastructure.

The Contractor shall provide a system that enables video data to be monitored by and from near field mobile radio/PC based platforms at a distance of up to four (4) city blocks or 1,600 lineal feet. Data acquired in this mode shall be of quality sufficient to allow the monitoring personnel to view data that equals the quality of data as written to the onboard HDD device. The mobile data acquisition users, SEPTA Police and Transportation personnel and elects, shall be able to go online and acquire said data to local PC based systems without loss of storage and fidelity of data stored to the Vehicle HDD system.

**TS 9.9.6.1 Vehicle Camera System Installation Requirements**

**TS 9.9.6.1.1 General Requirements**

The Contractor shall install all required equipment to the vehicle in a manner consistent with industry standard practice and the requirements of §TS 10 of this specification. Up to twelve (12) Camera channels shall be provided. All color cameras shall provide built-in infrared lighting source.

<table>
<thead>
<tr>
<th><strong>40’ Bus</strong></th>
<th><strong>Notes</strong></th>
</tr>
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<tbody>
<tr>
<td>1 – Forward Facing</td>
<td>Non-articulating post mount, camera adjustability within housing</td>
</tr>
<tr>
<td>1 – Exterior Waterproof RS/curbside</td>
<td>Impact resistant, lens guard, low profile housing, shall not accumulate condensation/moisture</td>
</tr>
<tr>
<td>1 – Exterior Waterproof streetside</td>
<td>Impact resistant, lens guard, low profile housing, shall not accumulate condensation/moisture</td>
</tr>
<tr>
<td>1 – Entrance Facing</td>
<td></td>
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<tr>
<td>1 – Exit Facing</td>
<td></td>
</tr>
<tr>
<td>1 – Operator Overhead</td>
<td>Provision for install-no camera mounted at delivery</td>
</tr>
<tr>
<td>4 – Cross-field Interior</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>To be installed only if coverage cannot be attained.</td>
</tr>
</tbody>
</table>
All production buses shall have the camera system checked for function as part of the final inspection process. The contractor shall provide all camera views of each vehicle via WLAN. “Snapshots” of each camera view with proper labeling and identification shall be provided as part of the inspection documentation.

**TS 9.9.6.1.2 Workmanship**
The workmanship must be the best obtainable in the various trades. All wires, cables must follow generally straight line installation to avoid chatter and must not potentially chafe against adjacent metal or plastic components. Minimum safe tolerance shall be 0.125" unless specifically waived in writing by SEPTA. All punched and/or drilled holes shall be properly de-burred and bushed.

Special care shall be taken with the outside sheathing, roof, roof bonnets, and the interior panels so that drilling and/or punching does not cause damage and/or or water leakage.

**TS 9.9.6.1.3 Production Prototype**
As part of the Pilot Bus Program (Ref. §TS 5). The Contractor shall provide a first Article or Prototype installation that fully documents the mechanical and electrical vehicle interfaces, the equipment installation deployment and mapping, and all other necessary documentation required to ensure proper operation and maintainability. SEPTA shall inspect and make all required approvals at this program point. No other vehicle installations shall proceed until SEPTA installation requirements are satisfied.

**TS 9.9.6.1.4 System Operation**
**HDD Drive Interface**
The HDD system shall be configured to operate upon activation of the bus master switch to run mode. The system shall be arranged to record data from all cameras for 30 minutes after the bus master switch is set to it’s off position.

**TS 9.9.6.1.5 HDD Drive Location**
If not located at AVL/M Cabinet:
The location of the HDD device shall be determined during the pre-production Engineering Design Review Meetings, Ref. §TS 5. The drive shall be properly arranged for sustainable structural mounting durability. The HDD shall be arranged for ease of maintenance and other attendant operating circumstances.

**TS 9.9.6.1.6 Camera Mounting(s)**
Camera locations shall be determined as specified by the Camera Installation Pilot Program § TS 9.9.6.1 (Camera Mounting). Upon First Article camera selection agreements, no alteration of camera location(s) lensing or other physical location circumstances shall be permitted unless directed by SEPTA due to a demonstrable coverage issue defect. All cameras and housings shall be securely mounted using tamper resistant hardware. All cameras shall maintain their initial adjustment points and settings under customary and routine 3 axis vibrations attendant to transit bus operation and camera systems shall not be re-adjust for drift to a degree that diminishes their initial set positions.
TS 9.9.6.1.7 Panic Button/Status Lamp Panel
The tagged event/Status Lamp Panel assembly shall be located in the driver’s area. The switch button/status lamp panel location shall require SEPTA approval at Pilot Bus Inspection.

TS 9.9.6.1.8 Digital Output
The Contractor shall provide an output that shall integrate into its AVM system.

TS 9.9.6.1.9 Digital Inputs
The Contractor shall configure an analog, digital or CAN signal input signal that shall initiate an orderly shutdown of the system or equal system.

TS 9.9.6.1.10 3-Axis Sensor Installation Requirements
A 3 axis accelerometer shall be installed that shall interface directly to the camera System HDD. The device shall report impacts within applied parameters and said event shall be recorded to the system HDD with a date and time stamp. The Contractor shall provide the necessary source and programming required to permit CAN open and/or discreet event condition to 3rd party devices.

TS 9.9.6.1.11 Documentation
The Contractor shall supply all schematics, diagrams and related service and parts manuals required to maintain, troubleshoot, diagnose and service the specified system. Complete sets of the described material shall be provided at a rate of one set for every ten buses delivered.

TS 9.9.6.1.12 GPS and Time Tracking
The system shall be equipped with GPS sourced hardware, along with a system software redundancy that ensures reliable time and location acquisition and adjustments. The GPS system shall be integrated with the AVL/M system therefore, sharing a common GPS receiver and radome.

TS 9.9.6.2 Emergency Help Light and Switch
An emergency "Help" light shall be installed toward the left front corner of the roof, and the switch for activation of a "Help" light shall be installed on the operator's left side console. Aside from the "Help" light switch activating the "Help" light, it shall also activate the emergency message on the destination sign.

The help light switch location shall be parallel to the operator's left leg. The switch shall be labeled and equipped with a protective cover to prevent inadvertent activation.

Upon activation, the switch shall cause a roof-mounted light to flash. On fairing equipped vehicles, a distributed group of amber LED lamps shall be integrated to the forward facing (200° arc, 100° from vehicle center line, left-right) Refer to Attachment to Section TS 11.25 Technical Specification for additional information. A minimum 4 high intensity LED lamps shall be provided. Coincident to the roof light flash activity the exterior destination signs shall display the message "HELP GET POLICE!" continuously until reset by the operator as defined by the
electronic section of this specification. There shall be no changes in the routine operation of interior signs, side signs or audio annunciation’s.

**TS 9.9.6.3 Emergency Alarm (EA) Switch**

The Emergency Alarm (EA) switch shall be located parallel to the operator's left leg at a distance sufficient to permit ready access to the operator but far enough away from the Help Light Switch to avoid confusion of the switch functions. The EA switch shall be guarded by a ring and shall be the same color as the side dash panel. All switch configurations pursuant to this section shall require SEPTA approval at the PILOT INSPECTION.

When activated the EA switch shall activate the "HELP GET POLICE" message and coincidentally break the continuity in the radio system EA circuit, the result of which is to send a distress signal via the radio to SEPTA's Control Center. SEPTA radio circuit details shall be provided when needed to the Contractor. When activated, the EA switch function shall not change the operating mode of the interior sign(s) or audio annunciations. The system shall automatically reset upon power shut off and manually be cancelled by the operator with a soft key arrangement of the AVL/M controller.

**TS 9.9.7 Intelligent Vehicle Systems/Automatic Vehicle Location/Monitoring-IVS-AVL/M**

This section details the performance and other salient features and requirements for an integrated system that shall provide ADA compliant vehicle based stop announcements, vehicle performance and safety monitoring, vehicle telemetry services, support various vehicle systems analytic services and other best vehicle use practice verifications.

The IVS Contractor shall by vehicle equipment deployment and by installation of all other on-board and facility-related off-vehicle, physical, software and sundry items and integration of same, deliver complete, fully functional systems. Clever Devices shall make all required facility survey, define the types of servers and related equipment required to affect said system from signal and data origination to user interface terminals and structured and customer defined reports. Clever Devices shall map out and partner with Septa’s IT department to ensure all server backhaul and like steps are arranged. User interface software, including Clever Devices BusTime®, AVM®, CleverReports, and Clever Analytics (Idle Monitor™ & Incident Analytics™), shall be supplied by site license with no number of user restrictions. The contractor shall price these systems separately as part of the price proposal in Appendix 2, Items #12-15.

The systems shall support current data and voice CARD based infrastructure and shall be arranged to provide the lowest possible upgrade pathway expense.

The system shall support LTE based services for those system elements and performance requirements as configured by SEPTA. The system shall permit and support full and/or ratio based data throughput between CARD and LTE systems.

**IVS onboard System**

The IVS system and will consist of the following components: Controller, Mounting Bracket, Bus Interface Harness, Multi-Band Roof-Mount Antenna (used for Wireless LAN, Cellular Communication and GPS), Wireless LAN Antenna Cable and GPS Antenna Cable and additional elements as specified herein and throughout. The components shall be physically arranged as defined by § TS 9.9.4.4.1.

The main processor shall be Clever Devices IVN, (Intelligent Vehicle Network) device. The IVN shall interface, control and support all system physical and operational devices. Xerox, ACS AMDT shall provide a single point
login feature for all attendant users including Clever Devices, Xerox NPT technologies (optional), and user defined, network supported user interfaces. The Clever Devices system shall emulate all related login functions, safety and voice channel requests, route selection, and miscellaneous functionalities. The emulation device or a Clever Devices standard user interface (UI) shall be located in the equipment cabinet. The device and attendant cabling and hardware shall be easily relocated. Sufficient UI cabling shall be stored serviceable at or near the UI device equipment cabinet location.

The UI shall be arranged and bracketed. The UI shall be fully integrated, support all system log-on functions and shall be arranged to provide defined switch function via soft-key provided form user input screen templates as follows:

- §7.5.1.1 Ambient Temperature Controlled Idle Shutdown-Enabled/Disabled
- §7.5.5.2 (iv) Brake Pedal Function Disable regenerative braking per instruction
- §7.7.5.5 Emission Systems Data Recording Requirements switch function
- §9.5.3.1. General and safety-Vapor Class system Enable/Disabled switch

The Contractor shall supply a bus with an Intelligent Vehicle System (IVS). This will provide accurate, reliable and timely bus performance and fault information and improve vehicle and passenger safety and security. IVS will be integrated with the on-board microprocessor controlled systems and with Wireless and Ethernet LAN to create a fully intelligent vehicle that will increase vehicle performance, optimize fleet utilization, and increase operational efficiency.

The IVS is primarily constituted of bus on-board system. The bus onboard system will have the main function to collect the fault and performance data from all of the microprocessor based systems and deliver services and tasks described in the following.

The wayside system is required to collect fault and performance data downloaded from the buses through the wireless link and to generate customizable reports. Data requiring LTE services shall be arranged as defined herein and as amended in order to satisfy specific and overall operational requirements.

The Contractor shall supply the IVS system in accordance with the requirements outlined herein. The Contractor and IVS supplier shall develop a scope of supply, system integration and implementation.

The Bus Manufacturer shall be responsible for proving the installation of the IVS in the bus, the functional interfaces between this equipment and the bus, and to ensure that bus systems comply with the requirements of this appendix. The supply and proper functioning of all interfaces shall be provided in accordance with the requirements of this Specification.

The IVS Contractor shall ensure and audit interoperability from all necessary systems and components. Required system testing and audit plan shall be submitted at bid. The IVS Contractor shall map out and partner with Septa’s IT department to ensure all server backhaul and like steps are arranged.

**TS 9.9.7.1 Automatic Stop Announcement System (ASAS)**

The term ASAS system shall refer to the following:

1. The Global Positioning Satellite System (GPS), and Logical Positioning System (LPS), which provides the geographical location of the vehicle. The system gathers satellite-based information and correlates the information to land-based maps. Land based maps are converted with overlays to route-based maps.
Software based maps can be configured to recognize various types of triggers. Triggers can define certain route based information to be used for vehicle location and stop announcements.

2. The voice data storage unit and public address system.

3. The unit or system that drives and/or controls visual signage.

4. The unit and/or system that permits programming or system up/down load.

5. The unit that interfaces the ASAS system to the operator.

6. Power supplies, interconnect cabling and all other ancillary equipment.

**TS 9.9.7.2 General Requirements**

The system shall operate using a single Global Positioning Satellite System (GPS) receiver and vehicle based logical positioning system (LPS). The two systems shall provide location resolution sufficient for system defined trigger box operation at the smallest defined area required by the maximum system announcement density points.

a. **General** The system shall be capable of playback of a minimum of fifteen thousand seconds (15,000) of unique announcement time, stored locally at the device.

b. **Announcement Requirement System** shall provide geographically synchronous audio-visual next stop announcements, current stop announcements, and preprogrammed and manually controlled public relation and route-related information.

c. **Location Accuracy.** The system in all operating modes shall indicate vehicle location to within the length of the vehicle.

d. **System Architecture.** The system and components shall be designed to permit integration with current digital and analog-type trunked radio systems. The Contractor shall provide all mapping software and hardware, to SEPTA along with a complete bill of material coincident to the PILOT INSPECTION. The Contractor shall disclose to SEPTA all required proprietary methods, software, tools and associated equipment necessary to ensure the successful operation of the ASAS system.

i) Route Mapping-SEPTA shall be able to map and modify routes as required. The Contractor shall provide all requisite software tools and utilities needed to facilitate backward compatibility to all current ASAS systems.

ii) Edit Functions-SEPTA shall be able to perform all required system editing and scripting required to affect completely functional ASAS delivery.

iii) The Proposer shall disclose their standards for data communication, hardware and physical interfaces, and proposed system operation and integration. The Proposer shall provide schematic and block type diagrams detailing ports, interconnects and gateways. The Proposer shall provide a matrix detailing the time, methods (proprietary or common), and special tool(s) required for the functions.
e. **System Operation.** The Contractor shall demonstrate how the proposed system shall operate effectively through all topographical environments encountered in the effected coverage area.

f. **Audio Requirement General.** The system shall be able to produce audio announcements sufficient to meet all applicable sections of the Americans with Disabilities Act (ADA), 49 C. F. R., parts 27, 37 and 38. CD-DA quality audio shall be provided to the minimum level required to effect proper information exchange between the system and passengers under every operating condition of the vehicle.

g. **Visual Requirements.** The system shall meet or exceed all applicable portions of the ADA as referenced in this section. The interior visual sign shall be the LED type and shall be mounted in a manner consistent with good safety and mechanical practice. The interior sign shall be located at the ceiling center line in close proximity to vertical plane of the standee line. The exterior sign shall be programmed through and controlled by the ASAS system. The system as delivered shall not require SEPTA to reprogram from multiple ports.

h. The system shall be programmable through a system employing single point on board vehicle entry and remotely via Wi-Fi and LTE.

i. Exterior signs shall be Programmable and controlled by the ASAS system. All other salient features shall be defined by the requirements of Section TS 9.9.1.1, Exterior Signs.

j. **Event Triggers.** Announcement triggers shall be defined as follows:

   i) Trigger boxes developed by the mapping/route logistics process. These triggers define preprogrammed events.

   ii) Manual triggers from an operator accessible listing.

   ii) Date and time shall be displayed between messages.

k. **Reserved**

l. **Manual Mode Operation.** The operator shall be able to control all necessary authorized functions from the operator interface.

m. **Emergency Alarm Integration.** The system shall be configured to permit the Emergency Alarm system (EA), to cancel by means of a “hot key” function. The key shall be configured to cause the EA system to reset and shall be used for that function when the EA system has been activated.

**TS 9.9.7.3 Automatic Stop Announcement System (ASAS) System Programming**
Contractor shall provide the equipment and software necessary to program and reconfigure the ASAS system from route mapping to a full functioning system. The Contractor shall supply all equipment and software coincident to the “PILOT INSPECTION” vehicle, as there shall be a route modification procedure as part of the “PILOT INSPECTION” process. All new software must provide backward compatibility with current programming software. The Contractor shall provide user interfaces (software/hardware) that support this requirement.
The “PILOT INSPECTION” (TEST), refers to a production vehicle that SEPTA and the Contractor shall select for the purpose of determining specification compliance pursuant to the ASAS, CARD-AVL and AVM systems and other related subsystems.

The Contractor shall supply two (2) end user work and recording or equal work station or personal computers. Refer to within Appendix 2 – Price Proposal, Attachment A - Capital Spares, Line 24 (Page 6). Ref: TS12.3 Project Code Red Label.

**TS 9.9.7.4 Performance Test**
The performance test shall be conducted on the test vehicle. The test vehicle shall be PILOT vehicle and the vehicle shall be equipped at a location mutually agreed upon by SEPTA and the Contractor.

The test shall consist of two (2) routes, selected by SEPTA. Upon notification, the Contractor, shall request all pertinent information required to begin the route mapping process, production of audio data, and all other related documentation.

Note: All relevant generic route information shall be requested by the Contractor, when the Contractor notifies SEPTA of an award of Contract to the system subcontractor.

Upon notice to proceed, SEPTA may request project status updates prior to the system’s required delivery at the PILOT INSPECTION.

a. **Performance Verification**
   The Contractor shall be responsible for the following:
   
   i) Provide all equipment necessary to affect an operational system.
   
   ii) The PILOT VEHICLE ASAS system shall be in form and function an operational and functional representation of the Contractor's proposed system. Upon notification by SEPTA that the Contractor's pilot vehicle system has met the requirements of SEPTA's test, the Contractor may submit a list detailing proposed modifications and/ or improvements for SEPTA approval. Any modifications or alterations shall be submitted in writing for review and approval by SEPTA.
   
   iii) The PILOT VEHICLE ASAS system shall be required to meet or exceed all functional and dynamic aspects of this specification during the PILOT INSPECTION period.
   
   iv) The test shall be conducted with SEPTA overview. SEPTA shall assign two (2) routes as test routes. The Contractor shall notify SEPTA when they begin the process, and thereafter on a weekly basis or as required by SEPTA. The Contractor shall submit their timetable and notify SEPTA as to the status of the following project milestones:
   
   1. Route mapping completed.
   2. Route scripting and trigger box selection.
   3. Stop announcement recording process.
   4. The process of combining mapping, trigger box definition, scripting and voice recording, assembly of process to final programming of system data base.
   5. Upon completion of the above tasks the Contractor shall provide SEPTA with the actual amount of time, memory and other factors required to effect operation of the test system.
SEPTA may elect to be represented at any time during the test system development process at the vehicle Contractor's plant and/or subcontractor’s facility.

b. The test shall commence upon mutual agreement between SEPTA and the Contractor. The testing shall commence with the following prerequisites;

i) The Contractor supplies system operation and validation information.

ii) The Contractor can demonstrate through their bill of material, and other documentation that the test system represents their tentative “final configuration”. The system demonstrated is by form, fit and function a representation of the system they intend to deliver to all subsequent vehicles provided for by this Contract, sans mutually agreed upon or SEPTA requested engineering change notices after the pilot vehicle configuration. Included in the bill of material shall be a software version control number system and validation process.

iii) The Contractor shall supply all equipment necessary to validate and document the accuracy of the vehicle stop announcements. The Contractor shall be able to demonstrate the system accuracy in real time, and by transportable data format, that is Windows based. SEPTA shall be supplied with a copy of the test series result.

iv) The Contractor shall supply as a condition of test any/all software and interconnect cables required to export data that is route, exception or otherwise defined.

c. Test Accuracy. The acceptance for vehicle location accuracy shall be within forty (40) feet of the actual location of the vehicle as determined by an average of ten (10) stationary land marks at ten (10) different points through the test procedure.

The acceptance for the stop announcement shall be 100% conformance to the database and trigger box locations.

**TS 9.9.7.5 Automatic Vehicle Monitoring System (AVM)**

The following tables define vehicle data to be captured, processed, stored and exported via LTE and Wi-Fi based systems. The data as defined under this section shall reside on a single, on-vehicle system. The system shall have the vehicle number written to it. User defined data shall be exportable from the IVS/AVM storage space via 802.11ac wireless to wayside LAN systems. All recorded data shall be date and time stamped.

The IVS Contractor shall map out and partner with Septa’s IT department to ensure all server backhaul and like steps are arranged. User interface software, Clever Devices AVM®, shall be supplied by site license with no number of user restrictions. The Contractor shall price this system separately as part of the price proposal in Appendix 2, Item #12.

<table>
<thead>
<tr>
<th>Table 1: Vehicle Signals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No.</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td></td>
</tr>
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<tr>
<td>3</td>
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<td>4</td>
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<td>6</td>
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<td>7</td>
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<td>15</td>
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<td>19</td>
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<td>29</td>
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<tr>
<td>31</td>
</tr>
<tr>
<td>32</td>
</tr>
</tbody>
</table>
### Table 2: Engine

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Diagnostic fault codes</td>
<td>23</td>
<td>Engine Fuel Rate</td>
</tr>
<tr>
<td>2</td>
<td>Wheel-Based Vehicle Speed</td>
<td>24</td>
<td>Engine Coolant Temperature</td>
</tr>
<tr>
<td>3</td>
<td>Vehicle Identification Number</td>
<td>25</td>
<td>Engine Average Fuel Economy</td>
</tr>
<tr>
<td>4</td>
<td>Unit Number (Power Unit)</td>
<td>26</td>
<td>Electrical Potential (Voltage)</td>
</tr>
<tr>
<td>5</td>
<td>Trip Distance</td>
<td>27</td>
<td>Date</td>
</tr>
<tr>
<td>6</td>
<td>Total Vehicle Distance</td>
<td>28</td>
<td>Exhaust Gas Temperature 1</td>
</tr>
<tr>
<td>7</td>
<td>Software Identification</td>
<td>29</td>
<td>Particulate Trap Outlet Gas Temperature</td>
</tr>
<tr>
<td>8</td>
<td>Maximum Vehicle Speed Limit</td>
<td>30</td>
<td>Catalyst Tank Temperature</td>
</tr>
<tr>
<td>9</td>
<td>Intake manifold pressure</td>
<td>31</td>
<td>Catalyst Tank Level</td>
</tr>
<tr>
<td>10</td>
<td>Hours</td>
<td>32</td>
<td>Barometric Pressure</td>
</tr>
<tr>
<td>11</td>
<td>Engine Turbocharger Boost Pressure</td>
<td>33</td>
<td>Air Inlet Temperature</td>
</tr>
<tr>
<td>12</td>
<td>Engine Trip Fuel</td>
<td>34</td>
<td>Engine Air Inlet Pressure</td>
</tr>
<tr>
<td>13</td>
<td>Engine Total Idle Hours</td>
<td>35</td>
<td>Engine Coolant Level</td>
</tr>
<tr>
<td>14</td>
<td>Engine Total Idle Fuel Used</td>
<td>36</td>
<td>Engine Crankcase Pressure</td>
</tr>
<tr>
<td>15</td>
<td>Engine Total Hours of Operation</td>
<td>37</td>
<td>Engine Load (%)</td>
</tr>
<tr>
<td>16</td>
<td>Engine Total Fuel Used</td>
<td>38</td>
<td>Number of Emergency Stops</td>
</tr>
<tr>
<td>17</td>
<td>Engine Speed</td>
<td>39</td>
<td>Software Identification (Calibration Version)</td>
</tr>
<tr>
<td>18</td>
<td>Engine Percent Load at Current Speed</td>
<td>40</td>
<td>Road Speed PGN65265 SPN84 at a consistent 100ms broadcast rate</td>
</tr>
<tr>
<td>19</td>
<td>Engine Oil Pressure</td>
<td>41</td>
<td>Component Identification (Engine Serial Number)</td>
</tr>
<tr>
<td>20</td>
<td>Engine Serial Number</td>
<td>42</td>
<td>Calibration Information (DM9)</td>
</tr>
<tr>
<td>21</td>
<td>Engine Oil Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Engine Intake Manifold 1 Temperature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3: Propulsion System

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Diagnostic fault codes</td>
</tr>
<tr>
<td>2</td>
<td>Battery Potential (Voltage)</td>
</tr>
<tr>
<td>3</td>
<td>Engine Requested Speed/Speed Limit</td>
</tr>
<tr>
<td>4</td>
<td>Reserved</td>
</tr>
<tr>
<td>5</td>
<td>Software Identification</td>
</tr>
<tr>
<td>6</td>
<td>Input Shaft Speed sensors (all)</td>
</tr>
<tr>
<td>7</td>
<td>Transmission Output Shaft Speed</td>
</tr>
<tr>
<td>8</td>
<td>Transmission Oil Temperature</td>
</tr>
<tr>
<td>9</td>
<td>Transmission Oil Level High/Low</td>
</tr>
<tr>
<td>10</td>
<td>Transmission Oil Life Remaining</td>
</tr>
<tr>
<td>11</td>
<td>Transmission Range select/obtained</td>
</tr>
<tr>
<td>12</td>
<td>Propulsion system faults generic and per TS 7.5.4 Safety</td>
</tr>
</tbody>
</table>

### Table 4: Multiplex System
Performance data shall consist of but is not limited to current draw, electrical arcing to ground, system shutdown alerts and input and output status. The multiplex system shall report the performance data given in the table below. The final list of the performance data will be finalized when the system configuration is made available from the Contractor. The maximum number of signals required will depend on the multiplexer’s capabilities. The system shall be able to add delay or maintain required persistence in order manage and maintain required and necessary data accuracy and fidelity. Condition or parameter changes will be made by the system supplier.

NOTE: The J1939 compliant multiplex system shall interface with the controller and transmit diagnostic fault codes (DM1, BAM or PID194, Multi-Section Parameter) available on the network. If a gateway is required for monitoring of the IVS system then a gateway shall be provided by the contracted bus builder. The Contractor, their subsystem suppliers shall furnish a complete system DBC file as part of customer specification requirement and commissioning audits.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Range-select/obtained</td>
<td>14</td>
<td>Wheel Chair Ramp Deployed</td>
</tr>
<tr>
<td>2</td>
<td>Network Failure</td>
<td>15</td>
<td>Engine Start Cycles</td>
</tr>
<tr>
<td>3</td>
<td>Fuel Filter Service</td>
<td>16</td>
<td>Climate Control Switch</td>
</tr>
<tr>
<td>4</td>
<td>Engine Air Filter Service</td>
<td>17</td>
<td>Air Dryer/Drain Valve (Indicate qualifying current draw-report unit status)</td>
</tr>
<tr>
<td>5</td>
<td>ABS Indicator</td>
<td>18</td>
<td>Parking Brake</td>
</tr>
<tr>
<td>6</td>
<td>LVDC System Status-LVDC SOC/H VA, Temperature(s)</td>
<td>19</td>
<td>Front door fully open</td>
</tr>
<tr>
<td>7</td>
<td>Low Air Pressure</td>
<td>20</td>
<td>Front door fully closed</td>
</tr>
<tr>
<td>8</td>
<td>Check System</td>
<td>21</td>
<td>AFSS Fire Suppression System Alarm</td>
</tr>
<tr>
<td>9</td>
<td>Stop System</td>
<td>22</td>
<td>Fire-Engine Shutdown (Number and stage)</td>
</tr>
<tr>
<td>10</td>
<td>Kneel Down SW</td>
<td>23</td>
<td>Fire System Ok</td>
</tr>
<tr>
<td>11</td>
<td>Throttle Malfunction switch and/or counts</td>
<td>24</td>
<td>Stop Requested (does not include wheel chair stop request)</td>
</tr>
<tr>
<td>12</td>
<td>HVAC System Failure</td>
<td>25</td>
<td>Software Identification</td>
</tr>
<tr>
<td>13</td>
<td>Wheel Chair Stop Request</td>
<td>26</td>
<td>Propulsion System Status</td>
</tr>
</tbody>
</table>
### Table 5: ABS System

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All diagnostic fault codes (DM1, BAM)</td>
</tr>
<tr>
<td>2</td>
<td>Road Speed</td>
</tr>
<tr>
<td>3</td>
<td>ABS Active</td>
</tr>
<tr>
<td>4</td>
<td>Software Identification</td>
</tr>
<tr>
<td>5</td>
<td>Wheel Speed PGN65215 SPN904 at a consistent 100ms broadcast rate</td>
</tr>
</tbody>
</table>

### Table 6: Door Systems

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diagnostic fault codes</td>
</tr>
<tr>
<td>2</td>
<td>Rear Door Count</td>
</tr>
<tr>
<td>3</td>
<td>Rear Door ([sensitive edge operated-on closing to 5° limit switch/upon active switch @ 5°’s monitor until signal stops reporting] Report as defined (unique) mnemonic metadata)</td>
</tr>
<tr>
<td>4</td>
<td>Front Door Count</td>
</tr>
<tr>
<td>5</td>
<td>Wheelchair Ramp Cycles</td>
</tr>
<tr>
<td>6</td>
<td>Kneel Cycle Count</td>
</tr>
<tr>
<td>7</td>
<td>Emergency Override Switch Count</td>
</tr>
<tr>
<td>8</td>
<td>Auxiliary Systems Status In/Cutout</td>
</tr>
<tr>
<td>9</td>
<td>Door Motor Current Loading (Report if out of bounds)</td>
</tr>
<tr>
<td>10</td>
<td>Rear Door opening or closing time exceeds expected parameter</td>
</tr>
<tr>
<td>11</td>
<td>Rear Door-log if no sensitive edge counts generated per nth operations obtained</td>
</tr>
</tbody>
</table>

### Table 7: Climate Control System

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
<th>No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ambient Air Temperature</td>
<td>10</td>
<td>Discharge Pressure</td>
</tr>
<tr>
<td>2</td>
<td>Floor RA Temperature</td>
<td>11</td>
<td>Suction Pressure</td>
</tr>
<tr>
<td>3</td>
<td>Discharge Air Temperature (Interior Cabin Air)</td>
<td>12</td>
<td>Operating Mode</td>
</tr>
<tr>
<td>4</td>
<td>Discharge Pressure</td>
<td>13</td>
<td>Evaporator Motor Hours</td>
</tr>
<tr>
<td>5</td>
<td>Return Air Temperature</td>
<td>14</td>
<td>Condenser Motor Hours</td>
</tr>
<tr>
<td>6</td>
<td>Performance Data</td>
<td>17</td>
<td>Software Identification</td>
</tr>
<tr>
<td>7</td>
<td>Water Inlet Temperature</td>
<td>18</td>
<td>Compressor Motor Voltage/Current</td>
</tr>
<tr>
<td>8</td>
<td>Application File</td>
<td>19</td>
<td>Compressor Hours</td>
</tr>
</tbody>
</table>

Note: Climate Control unit data shall be transmitted only when the operator’s climate control switch is in the “ON” position. When the operator’s climate control switch is in the “OFF” position, only software ID of the climate control unit would be transmitted to the system controller.
TS 9.9.7.6  Computer Aided Radio Dispatch System-Automatic Vehicle Location System (CARD-AVL)

General Requirements
The CARD-AVL system shall provide text messaging at the operators interface display. System shall provide an interface board and/or integral wireless LAN transceiver. System shall be equipped with a suitable antenna and cabling. Required software shall be furnished.

The IVS/AVM system shall convey data when in range of the wayside transceiver. The system shall transmit system defined data for export and shall be able to receive data from the wayside wireless LAN for destination sign revisions up to and including complete re-write. The system shall provide supervision schemes that track vehicle specific data transfers. All destination sign remote programming shall be accomplished within 100 hours per 100 vehicles within range of the transceiver.

The AVL system shall also include a Route Schedule Adherence capability for CARD-AVL/RSA Ready Status. At SEPTA's discretion, SEPTA may activate the respective bus AVL/RSA system.

The CARD-Ready System includes the Automatic Vehicle Locator (AVL) and Route Schedule Adherence (RSA) capability. The Contractor shall certify and demonstrate that the Operators Display Unit is CARD-ready for operations upon delivery of a bus in Philadelphia. Upon implementation of LTE based vehicle location services this section may be amended, subordinated or modified by SEPTA in order to produce the most reliable/lowest cost AVL system fully supporting real time vehicle location services and CARD system data functions.

There shall be no additional cost to SEPTA to fully utilize this information on the current SEPTA CARD system. The AVL/RSA modules shall be designed to permit integration with current digital and analog radio, LAN transceiver and cell phone based data transmission systems.

The Route Schedule Adherence function provides bus information for monitoring the performance of the vehicles on a route by CARD dispatch. Route Schedule Adherence information as part of the CARD-AVL system shall convey data when in the range of the wayside transceiver as noted in this section.

Route Schedule Adherence programming shall be compatible with existing CARD System protocols. All licenses required to permit SEPTA to operate, maintain and modify the AVL/RSA systems for the lifetime of the vehicle shall be included at no additional cost to SEPTA.

There shall be no recurring operating fees from third-party suppliers unless approved by SEPTA.

The Operator's Display Unit (ODU) shall be forward/backward compatible with all other buses in the fleet.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All IVS diagnostic fault codes (DM1, BAM)</td>
</tr>
<tr>
<td>2</td>
<td>All IVS software versions</td>
</tr>
<tr>
<td>3</td>
<td>Watchdog monitor fault codes for all internal IVS components capable of being reset or restarted by software. (The code will be flagged when a specified amount of resets is necessary in a given time period.)</td>
</tr>
</tbody>
</table>
TS 9.9.7.7 Vehicle Location Services
The basic AVL/M system shall support Real-Time Passenger Information services. Said service module shall poll vehicle location at frequencies specified herein (X/T) using LTE supported GPS. The IVS Contractor shall furnish all backhaul and back office equipment required to affect a complete system as follows:

TS 9.9.7.7.1 Support Clever Devices BusTime® Real Time Passenger Information System
Support implementation of customer based Android and iOS cell phone applications for “stops near me” and vehicle location, next time arrival features. The IVS-AVL/M Contractor shall specify, deliver and coordinate the installation of all back haul and back office required to affect a full and complete operational system from vehicle to SEPTA’s LTE supplier. Support customer traffic alerts and SMS message services. Support bus stop location references. Support multiple user language. Support and integrate schedule adherence, prediction and performance data backhauls. The configuration of the functional interfaces will be finalized during the technical evaluation process.

Each bus shall be provided with one controller that will deliver the functions of the on board System. The main functions are listed below:
- Automatic Vehicle Monitoring
- Hard Brake and Last Stop Reporting
- GPS and Dead Reckoning
- Automatic Vehicle Annunciation
- Automatic Passenger Counting

Mobile Data Terminal
The Proposer is required to present the complete implementation of the IVS, its features and its provisions for technical compliance review.

TS 9.9.7.7.2 Support Clever Devices CleverReports Business Intelligence Suite System
Support implementation of business intelligence suite system, CleverReports, for ad-hoc reporting for key vehicle performance indicators. The IVS-AVL/M Contractor shall specify, deliver and coordinate the installation of all back haul and back office required to affect a full and complete operational system from vehicle to SEPTA’s LTE supplier. The system shall support data collection from the AVL/M systems. The CleverReports system shall interface and collect all necessary data from SEPTA’s existing infrastructure in terms of vehicle scheduling and dispatch systems. Said system shall support real-time and historical reporting with full ad-hoc capabilities. The system shall support complete data integrity from the vehicle to the user interface. User interface software, Clever Devices CleverReports, shall be supplied by site license with no number of user restrictions. The Contractor shall price this system separately as part of the price proposal in Appendix 2, Item #15.

TS 9.9.7.8 IVS Controller hardware requirements
There shall be one controller per bus which should have a service life equal to the design life of the bus. The controller shall be capable to communicate with any bus subsystem capable of interfacing on a network as specified in herein and throughout this specification. The controller shall include a built in audio module with an audio controller, microphone input, volume control input to allow for automatic volume control.
The controller shall be designed with a navigation system based on a combination of GPS and dead reckoning. The controller shall interface with SEPTA’s Orb-Guide/Star 8400 or equal, operators interface unit.

A non-volatile flash high speed memory of minimum storage capacity of sixty four (64GB) will serve as the main storage device for the controller’s program functions, navigation information, fault and performance data, audio data and processed data. Memory shall be immune from external environmental or electrical conditions.

The controller shall incorporate a sleep function with automatic shut down within a configurable time after the run switch is turned to the off position. The system shall not malfunction if battery power is removed before the automatic shutdown is initiated.

**TS 9.9.7.8.1 IVS Bus Communication Antenna**

Wireless communication shall be IEEE 802.11ac compliant. The system shall contain a multi-band antenna with cable that will allow the controller to have at a minimum GPS satellite communication, Wi-Fi communication via IEEE 802.11, cellular communication. There shall be one antenna per bus. Antenna and cable shall have a service life equal to the design life of the bus. The bus manufacturer will install the antenna and the cable in conformance to this specification.

**TS 9.9.7.9 IVN Controller Features**

**TS 9.9.7.9.1 Vehicle Monitoring**

The vehicle monitoring system shall automatically collect selected bus systems faults and operational performance data that will be transmitted simultaneously to the controller via the on board communication protocols (SAE J1939 Network, SAE J1708/J1587 Network, RS-232/485).

The system shall be capable of verifying active communication between all monitored systems and the system controller, and be capable of using multiple communication protocols simultaneously (SAE J1939 Network, SAE J1708/J1587 Network, RS232/485).

As system equipped vehicles come into range of the wireless LAN at the depot, all collected data (vehicle ID, all fault codes, and selected operational performance data defined herein and throughout shall be automatically transmitted to the server and loaded into a format compatible with the depot system server. All data shall be presented in US or Metric units as SEPTA specifies and/or as required to affect required function outcomes. All data shall be capable of being presented using manufacturers fault and/or SAE definitions. Bus and sub-component manufacturers shall provide all necessary documentation/support to ensure that all points are monitored properly with the actual fault/performance data point descriptions as they appear in all respective bus/sub-component maintenance manuals. In addition to all standard SAE vehicle area network data points, all data point specified to be indicated on the operators’ dashboard and in any respective bus/sub-component diagnostic software shall be broadcast on an SAE complaint vehicle area network making it available for monitoring by the IVS system.

When a gateway or an interface is used between the controller and the on-board communication systems, the gateway shall output all data to the controller in compliant formats. A Canalyzer test and a data review shall be performed by the bus manufacturer to confirm all data availability. The OEM shall provide a complete list of all available data points on the vehicle area network to support this process, this includes standard and proprietary data point addresses. The test result shall be submitted to SEPTA for review prior to bus configuration audit.

The following documents shall be submitted to SEPTA for technical review.
• List of all performance points that are capable of being monitored (for example, engine temperature and climate control compressor discharge pressure).
• List of all fault codes that are capable of being monitored (for example, engine code “2963”, climate control fault code “6”).
• The information above should be grouped by the system that is reporting the data (for example, Engine, HVAC, Multiplex, ABS and Door Control).
• Denote how each system communicates (for example, J1939, J1708, RS232/RS485).

TS 9.9.7.10 Fault Events
All fault codes on the bus networks (SAE J1939, J1708/J1587, or RS232/RS485) shall be monitored, reported and stored in a non-volatile flash memory drive of the controller. Fault codes shall remain available indefinitely or as on-board memory storage permits. Data will be purged on a first in first out (FIFO) basis. Fault code data shall remain available after disconnecting the 24V batteries if disconnection occurs not less than 10 seconds after turning off the master run switch.

The system shall not collect faults when the engine is not running. The system shall not collect any data when the bus master switch is in the off position. Diagnostic fault codes (DM1, BAM or PID194, Multi-Section Parameter) from each system are to be monitored and the frequency of collection shall be configurable. Utilizing proprietary or reserved PGNs, SPNs, MIDs, FMIs, and PIDs are will not be accepted as they are not compliant with SAE J1587 or J1939 or the intention of this specification. Conditions or parameters for collecting fault codes based on either time delay or number of events in a time period shall be user definable. Condition or parameter changes will be made by the supplier.

TS 9.9.7.11 Performance Data
All performance data stored by IVS shall be stored in non-volatile flash memory of the controller. Performance data shall remain available indefinitely or as on-board memory storage permits. Data will be purged on a First In First Out basis. Performance data shall remain available after disconnecting the 24V batteries if disconnection occurs not less than 10 seconds after turning off the master run switch.

The transmitted performance data to be monitored, the frequency of collection, and the stamped count format will be defined in the technical proposal. Conditions or parameters for collecting fault codes based on either time delay or number of events in a time period shall be user definable. Condition or parameter changes will be made by the supplier.

Tables defined by TS 9.9.7.5 1-8, are minimum performance data signals that each system is required to output to the controller and complete list of all fault/performance data points shall be provided to SEPTA as part of the technical design review described herein.

The Contractor shall verify the diagnostic fault and performance signals referenced in this section since they depend on the model of engine, transmission and other systems that will be supplied in the bus. Utilizing proprietary or reserved PGNs, SPNs, MIDs, FMIs, and PIDs will not be accepted as they are not compliant with SAE J1587 or J1939 or the intention of this specification. Any proprietary or reserved PGN may be rebroadcast on a compliant with SAE as described within this document.

TS 9.9.7.12 AVM™ Data Format and Availability
The automatic vehicle monitoring controller shall send and receive messages from all bus systems actively communicating and connected to the J1708 or J1939 networks. All system, subsystem, components and all
elements comprising functional systems that require the transaction of data necessary to effect a complete and functional AVM system shall report all messages, all message associated data, including propulsion supplier integration for extranet with the AVM system.

**TS 9.9.7.12.1 Data Definition**

Regardless of the communication protocol used, each bus sub-system supplier(s) shall provide an interface specification and data definition consistent with the provided interface. Manufacturers of systems to be monitored shall provide documentation for the data to be transmitted for each system, the interface protocol to be used and the data definition of the externalized data. Bus Manufacturer shall provide each system vendor with this appendix.

The bus contractor is responsible for monitoring bandwidth utilization to ensure sufficient throughput for network traffic and must assure that there are no network collisions, frame errors, etc.

The bus manufacturer must ensure that any bus system supplier that makes programming changes keep the existing data available. If any new faults or performance data is added during any program change it must be made available as per the J1939, J1708/J1587, and RS-232/485 requirements. If changes do occur the bus system supplier and the sub-system supplier must notify SEPTA of changes in writing. The bus contractor system supplier and the sub-system suppliers shall perform any necessary campaigns to ensure consistency by implementing changes across the entire fleet.

**TS 9.9.7.12.2 J1939 Bus System Fault Reporting and Performance Data**

All bus system non-diagnostic application layer messages must be formatted and transmitted in conformance with SAE J1939-71, “Vehicle Application Layer”. All performance data not made available through a broadcast must be available to the system controller via the Request PGN (59904), as described in SAE J1939-21, “Data Link Layer”. Utilizing proprietary or reserved PGNs or SPNs are will not be accepted as they are not compliant with J1939 or the requirements of this specification.

All IVS monitored devices on SAE J1939 must respond to requests for PGN 65242 (Software Identification).

**TS 9.9.7.12.3 Bus System Fault Reporting (DM1 Diagnostic Messages)**

All diagnostic (fault) application layer messages must conform to the requirements described in SAE J1939-73 “Application Layer – Diagnostics”.

At a minimum, all active bus system faults must be formatted and transmitted in accordance with paragraph 5.7.1 (“Active Diagnostic Trouble Codes (DTC)” – Message Type DM1 [PGN 65226]). These messages are to be broadcast, but shall also be available on request using the Request Message PGN [59904]. The Request PGN is described in J1939-21, “Data Link Layer”. The response to the DM1 request must be in accordance with paragraph 5.7.1 with regard to the formatting of DM1 messages. See “Transport Protocol”, below for details regarding the transmission of multiple packets (containing DTCs) using the Broadcast Announce Message (BAM).

The DM1 message involves the use of Suspect Parameter Numbers (SPNs) to identify a particular element, component or parameter associated with a J1939 network device Diagnostic Trouble Code (DTC). Where possible, bus systems shall use SPNs defined in the SAE J1939 specification when reporting faults. If there is no correlation to an existing SPN, values in the proprietary range must be used. These are the SPN values which span from 520192 (7F000 hex) to 524287 (7FFFF hex), inclusive.
TS 9.9.7.12.4 Transport Protocol - Broadcast Announce Message (BAM)
In all cases where a response or broadcast message will require greater than 8 data bytes, the capabilities of the Transport Protocol must be employed. Specifically, the Broadcast Announce Message Transport Protocol, as described in SAE J1939-21, “Data Link Layer”, paragraph 5.10; provides for the transmission of messages which encompass multiple packets of data. An example of such a transmission would be a DM1 message with more than one Diagnostic Trouble Code (DTC) being reported.

TS 9.9.7.12.5 J1587 Performance Data and Fault Reporting
J1587 Performance Data
All non-diagnostic or fault application layer status messages must be formatted and transmitted in conformance with SAE J1587, “Electronic Data Interchange Between Microcomputer Systems in Heavy Duty Vehicle Applications” and SAE J1708, “Serial Data Communications Between Microcomputer Systems in Heavy Duty Vehicle Applications”. All performance data are expected to be available via appropriate Message ID (MID), Parameter ID (PID), SID, Fault ID (FMI), assignments in accordance with these specifications. Utilizing proprietary or reserved FMIs, MIDs, and PIDs are will not be accepted as they are not compliant with SAE J1587 or the intention of this specification.

All IVS monitored devices on SAE J1708/J1587 must respond to requests for PID 234 (Software Identification).

TS 9.9.7.12.6 J1587 Fault Reporting
All diagnostic (fault) application layer messages must be formatted and transmitted in conformance with SAE J1587, “Electronic Data Interchange Between Microcomputer Systems in Heavy Duty Vehicle Applications” and SAE J1708, “Serial Data Communications Between Microcomputer Systems in Heavy Duty Vehicle Applications”. Specific attention shall be devoted to the use of PID 194 (Transmitter System Diagnostic Occurrence Count Table) to report the diagnostic condition of a device on the network. All fault reporting data are expected to be available via appropriate Message ID (MID), Parameter ID (PID), SID, Fault ID (FMI), assignments in accordance with these specifications.

TS 9.9.7.12.7 J1587 Multi-Section Parameter
PID 192 (Multi-section Parameter) is used to transmit parameters that are longer than what is limited by SAE J1708. A specified parameter can be broken into sections with each section being transmitted in a different message. This shall be used as appropriate.

TS 9.9.7.12.8 J1939 Compliant Devices Data Definition
All bus systems shall externalize all data including fault codes and performance data in a standard, non-proprietary J1939 format. All systems shall be assigned with a Source Address on the J1939 network. Specific detail for all Parameter Group Numbers (PGNs) supported (down to the individual parameters supported within the PGN) shall be provided to IVS supplier.
Details for each fault the device is capable of generating (using the DM1 message) shall include the Source Address (SA), Suspect Parameter Number (SPN), Fault ID (FMI), OEM Description and OEM Flash Code or Fault Code, if it exists. All bus systems shall also broadcast its software identification level to the system controller.

TS 9.9.7.12.9 J1587 Compliant Devices
All bus systems shall externalize all data including fault codes and performance data in a standard, non-proprietary J1587 format. MID on the J1587 (J1708) network and specific detail for all PIDs shall be provided to
the automatic vehicle monitoring controller. Details for each fault the device is capable of generating (using the PID 194 message) shall include the MID, PID/SID, Fault ID (FMI), OEM Description and OEM Flash Code or Fault Code, if it exists. All bus systems shall also broadcast its software identification level to the automatic vehicle monitoring controller.

**TS 9.9.7.13 Multiplex System Monitoring**
Multiplex systems shall be monitored via J1708/J1939 and/or RS232/485 and must be equipped with all necessary gateways and programming required to externalize/export data in a manner compatible with the automatic vehicle monitoring controller. Multiplex system sleep mode time shall be dynamic and orderly shutdowns shall be arranged as required by system, subsystem and action as defined throughout this specification. The J1939 compliant multiplexer system shall interface with the IVS controller and transmit diagnostic fault codes (DM1, BAM or PID194, Multi-Section Parameter) available on the network. Interfacing may require a J1939 multiplexer gateway if a gateway is required it shall be provided by the Contractor. Performance data to be supplied by the bus manufacturer shall consist of but is not limited to current draw, electrical arcing, system shutdown alerts and input/output state and other monitoring and supervision required to affect specified functional outcomes.

**TS 9.9.7.13.1 Door System Interface**
The IVS shall monitor the door system which may include door sensors that independently measure fully-open and fully-closed door positions. The bus must be equipped with open and close sensors on all doors. The system shall record all necessary fault codes broadcasted by door controller over the network used (J1939, J1708/J1587 or RS232/RS485).

The system shall be able to detect, calculate and record the opening and closing speed of all bus doors. The system will record and report a door open/close speed fault when the front door open/close speed is exceeding the speed and time defined.

**TS 9.9.7.13.2 Advanced Technology and Hybrid Drive Systems**
All advanced technology and hybrid drive-train systems shall broadcast information in compliance specified SAE J1939 and J1708/J1587 vehicle area network communication standards contained within this appendix. All equivalent data points specified above by the component system from standard diesel drive-trains shall be made available utilizing non-proprietary protocols.

The IVN system shall fully support all advanced propulsion traction and LVDC battery control strategies as defined in § TS 10.1.1.3 LVDC Battery Maintenance and where specified herein and throughout.

The final list of fault and data points shall be subject to SEPTA’s review-No Pilot bus may proceed until the Contractor certifies to specification compliance, configuration and audit plan. Any required changes to the firmware, harnessing, and other required interfaces shall be implemented fleet wide. If necessary the contractor shall perform fleet wide upgrade campaigns as necessary to ensure compliance with this appendix.

**TS 9.9.7.13.3 Hard Brake and Last Stop Reporting**
The IVS shall provide Hard Brake and Last Stop detection and reporting. The system shall utilize the most accurate available vehicle speed signal on the bus for Hard Brake and Last Stop. The system shall be able to use the brake and acceleration signals from odometer pulse, ABS, transmission, etc. Hard Brake and Last Stop functionality is an investigative tool for use primarily for accident investigation. Hard Brake/Last Stop shall monitor, collect and report the following data while the bus is running:
- Event Time and Date
- Vehicle Speed (mph)
- Deceleration Rate (ft/sec^2)
- Engine Speed (RPM)
- Antilock Brake System Status (ABS Active)
- Bus ID
- Brake pedal position (applied or not-applied)
- Engine Load (%)
- Torque Commanded (Hybrid Vehicles)
- Throttle (%)

All the above data signals shall be externalized by the applicable system in a manner compatible and recognizable by the IVS controller. These signals will be consistently broadcast every 100ms. The collected data shall be stored when either a Hard Brake or Last Stop event occurs.

Hard brake detection shall be defined as vehicle decelerations that exceed a threshold of 15 ft/sec^2 for more than 300ms. The thresholds shall be configurable by SEPTA.

A Last Stop occurs whenever the bus comes to a full stop. Stored Hard Brake data remains in the IVS controller until it is wirelessly transferred from the bus to a depot server or be manually copied from the bus. Stored Last Stop data shall be encrypted and only be manually copied from the bus.

A last stop event is defined as a change in the vehicle’s speed from forward motion to zero miles per hour. A hard brake will be considered as a last stop event if the hard brake event ends with 0 mph. The most recent five (5) last stop events shall be collected and stored on the IVS controller memory. Any last stop event other than the most recent five (5) last stop events will be deleted in the controller. Data collected for a last stop shall be the event itself and the data around the event which is called the snapshot data. The snapshot window shall be configurable from a minimum of two minutes before the event and one minute after the event. The most recent five (5) last stop events and associated snap shot data shall be continuously collected during the course of the day.

Hard brake and last stop accuracy shall be determined by comparing deceleration test results from the intelligent vehicle system and deceleration test equipment such as Vericom VC4000 or accelerometer. The error shall be within 5 percent.

Included with the Hard Brake/Last Stop functionality is the software tools required to upload and report Hard Brake and Last Stop events. For the Last Stop report generation, software shall be provided to SEPTA that allows authorized personnel to generate the report from the data that is copied from the bus. On the last stop reports, the time interval for each reading shall be 500 milliseconds. The IVS Contractor shall map out and partner with Septa’s IT department to ensure all server backhaul and like steps are arranged. User interface software, Clever Devices Clever Analytics (Incident Analytics®), shall be supplied by site license with no number of user restrictions. The Contractor shall price this system (including Idle Monitor™) separately as part of the price proposal in Appendix 2, Item #14.

**TS 9.9.7.13.4 Diesel Particulate Filter Active Regeneration Inhibit Control**

Diesel Particulate Filter (s) authorization shall be customer configurable as defined by this specification. A fleet management control scheme shall be provided by the IVM contractor wherein local and/or remote authorization rules, controls and strategies may be implemented. Those authorizations shall transact (over WiFi system) and be
stored until triggered from manual or geo-fenced based, or prohibited, with qualified operational status obtained coincident to DPF maintenance required and propulsion system qualifications obtained. Local control shall be retained as defined by §7.7.5.5. The IVS shall automatically inhibit active regeneration in predefined and configured geo-fenced areas. A geo-fenced area is an area that is fenced via coordinates interpreted by IVS’ GPS. An additional feature shall inhibit regeneration in all locations where the navigation system detects zero satellites for more than 5 seconds. If these areas are in a closed or semi closed structure, the IVS shall minimize the effect of satellite signal reflections. Temporary loss of satellite signals (1-3 seconds) when driving in SEPTA’s urban environment shall not inhibit DPF active regeneration. The geo-fence parameters shall be capable of being configured by SEPTA.

A ‘fail-safe’ system shall be employed whereby any IVS malfunction shall permanently inhibit active regeneration, unless overruled from local control. The “Exhaust Regen OFF” dash lamp shall flash only in the event of an IVN malfunction. During IVN initial booting, the “Exhaust Regen OFF” lamp shall stay on solid.

**TS 9.9.7.13.5 GPS and Dead Reckoning**  
The IVS shall have an onboard GPS unit. The GPS shall be comprised of self-contained hardware and software which includes a GPS receiver, gyrocompass and an interface to the odometer (available from the bus propulsion system).

**TS 9.9.7.14 IVS Based Idle Control and Telemetry**

**TS 9.9.7.14.1 General**  
The Contractor shall furnish a complete system that shall enable SEPTA to assign, designate, implement and monitor geographic and operations conditional vehicle engine idle control strategies. User interface software, Clever Devices Clever Analytics (Idle Monitor™), shall be supplied by site license with no number of user restrictions. The IVS Contractor shall map out and partner with Septa’s IT department to ensure all server backhaul and like steps are arranged. The Contractor shall price this system (including Incident Analytics™) separately as part of the price proposal in Appendix 2, Item #14.

The system shall be LTE and Wi-Fi based upon required or directed polling or domiciled data transfers. Instruction sets and rules shall reside in the IVN system.

**TS 9.9.7.14.2 Vehicle Based Controls**  
Vehicle idle condition identification shall be that condition as defined by the necessary arrangement of operators controls and switches wherein the vehicle is by system architecture designated to be in no range selected/obtained idle mode. Upon obtainment of idle mode set, the vehicle based system shall request instruction for idle management from the IVN system.

Where no specific prohibition to idling rule(s) exists as indicated from the IVN controller or IVN controller response is incomplete, otherwise irregular or imperfect, the bus logic shall obtain idling instruction from the applicable chassis based system multiplex as defined by TS 7.5.1.1.

Idling control is applicable upon vehicle run switch set to front run, master switch set to day or night run, other interlocks set.

Idling control from the run switch set to rear run shall operate to a programmed time defined by SEPTA and is not subject to any other idle strategy defined herein or throughout this specification.

**TS 9.9.7.14.3 Database**
The IVS Contractor shall define necessary bill of material for a complete system as follows:

b.) A complete system is a system that generates all required vehicle functions and interoperability’s.
c.) The IVS Contractor shall specify the type of servers, necessary interconnections and backhaul required to implement the system.
d.) The IVS Contractor shall design/apply the data base management and user interface systems.
e.) Septa shall designate specified geographic areas or zones whereupon the IVS Contractor shall map said zones and apply idle control rules.
f.) The IVN system shall obtain, store and export park brake applied, range select/obtained, magnetic brake set and time to set park brake (if exceeds defined value) as a defined process value and that data shall report on an exception based data transfer.
g.) Upon negotiated Wi-Fi transaction obtained the vehicle shall report accumulated data on an exception basis (where values exceeded rules or where no active zone obtained) for front run neutral.
h.) Upon negotiated Wi-Fi transaction obtained and as required the system shall transmit new or amended rules.
i.) All transmissions shall be acknowledged by system protocol.
j.) All idling attending rear run mode shall be reported.

TS 9.9.7.14.4 Backhaul and Back Office
The IVS Contractor shall ensure and audit interoperability from all necessary systems and components. Required system testing and audit plan shall be submitted at bid.

TS 9.9.7.14.5 Work Stations
The IVS Contractor shall furnish twenty work stations complete and ready for service.

TS 9.9.7.14.6 Administration
All work stations shall be arranged with administration and standard user privileges. Passwords shall be delivered to the project management upon delivery of equipment.

TS 9.9.7.15 System Performance & Interoperability
The Contractor and IVS supplier shall ensure that all vehicle system controllers, gateways, transceivers, data buses, system I/O and all other elements and control strategies shall operate as a system wherein said system shall perform all tasks and functions regardless of network traffic up and to including the maximum number of messages the system could transact under any maximum system operating profile, I/O state activity, processing and outcomes states.
The Contractor shall obtain from all system and subsystem contractors all DBC files, all input/output conditions, controls and actuation system priorities and control hierarchies, message priorities schedules and other system and subsystem controller information required to assemble an operating model for the proposed vehicle system.
The operating model shall be tested for full compliance as a system in order to assure that all data polled, transacted, exchanged, requested and acknowledge, stored and exported shall be reliably sourced, recorded and exported.

TS 9.9.7.16 IVS System Scope of Work, Test Plan and Commissioning Documents
General
The Vehicle Proposer/Bidder/Contractor shall provide a scope of work document the purpose of which is to fully and completely describe the system, its operating physical layer and software elements required to obtain a complete and functional system as specified and clarified by Septa.
The above document as specified herein shall be delivered to Septa’s Project Management as part of proposer’s and Bidder’s submittals. Upon notification from Septa’s Project Management a conference or meeting may be arranged where Vehicle system and IVS system Proposers/Bidders shall in separate meetings through the implementation of a written questionnaire obtain a fully reconciled and conformed proposal.

The Proposer/Bidder/Contractor (PBC) and Septa may at Septa’s sole discretion require a document from the PBC and matrix whereby the PBC and Septa shall categorically agree with and from the IVS system supplier whereby the IVS system, subsystem, BOM, physical layer description of equipment and all other operating real or software related components to the elements prescribed by said document are fully those required to affect the operating outcomes as specified herein, throughout and as clarified by Septa’s Specification.

The plan shall fully and completely describe the Critical path method (CPM) required to obtain a fully function system as specified herein and throughout the Septa Specification document.

**TS 9.9.7.16.1 System Bill of Material (BOM)**
The IVS system proposer/bidder shall furnish as part of this bid the following draft level plan:
The IVS contractor shall furnish a completed BOM where all physical layer components and system elements are fully specified. The IVS contractor shall furnish a completed BOM where all software and virtual components and system elements are fully specified.
The IVS contractor shall furnish a completed BOM where all Back Office equipment, servers, switches and like equipment and system elements required to affect a functionally complete system for those systems that required immediate activation and functionality or where functions specified may be implemented based upon fleet milestone as specified or clarified by Septa may be obtained.

**TS 9.9.7.16.2 Critical Path Method (CPM)**
The Proposer/Bidder/Contractor shall furnish a CPM plan whereby the Proposer/Bidder/Contractor shall describe the plan for implementation as an operating system whereby system elements, the system as a function element, the infrastructure and contracted services required to affect the system operational requirements and goals are met.

**TS 9.9.7.16.3 Technical Conformance Reporting Instruction to Contractor**
The Contractor shall require all subcontractors to fully comply with all stated and/or required technical provisions and pathways for data sourcing and exchange. The IVS Contractor shall instruct all system, subsystem and related interests to fully comply with all stated and/or technical provisions for data sourcing and exchange. The Contractor shall report all nonconforming contractors to Septa’s Project Management on a periodic basis as defined by Septa’s Project Management.

The IVS Contractor shall report all nonconforming contractors to Septa’s Project Management on a periodic basis as defined by Septa’s Project Management.

**TS 9.9.7.16.4 Test Plan**
The PCB shall submit a test plan.
The IVS PBC shall submit a test plan.
The PCB shall submit a reconciled test plan.
The test plan shall fully and completely describe all system, subsystem data and voice testing required to affect a fully functional, specification compliant system.

**TS 9.9.7.16.5 Commissioning**  
The Contractor shall submit a test plan for the commissioning of the system in its entirety. The plan shall detail the CPM plan, Gantt chart, personnel deployments, Septa participation elements and all other necessary activities required to complete, commission and make ready for service the IVS system described herein and throughout this document.

**TS 9.9.7.16.6 Documents**  
The Contractor shall furnish the following:

- **TS 9.9.7.16.6.1 Physical Layer System**
  a.) Schematic diagrams for all discreet and network vehicle systems wiring. All IVS device to device wiring.
  b.) Full schematics required to maintain and repair all IVS and related operating devices, IVN, and IVN interconnected devices.
  c.) Functional diagrams, system descriptions for all IVS system elements.
  d.) Boundary scan tools for all system elements.
  e.) Two complete operating models for the Electronics Shop

**TS 10 Electrical System**

**TS 10.1 General Requirements**

**TS 10.1.1 Electrical System General**  
The electrical system shall provide and distribute power to ensure the proper operation of all vehicle systems under all operating circumstances. The electrical system shall supply power at two (2) primary voltages, 24 volts and 12 volts direct current, nominal. The power converting system output shall be sufficiently greater than the maximum system demand at any operating profile or mode. The charging system must, at all times, maintain the ability to properly charge the batteries and maintain full load demand (Ref. 10.6.1 for Load Mitigation). All cabling shall be indelibly and conspicuously labeled for identification including drawing plate references. All network and data cables shall be arranged with a separate color identifying loom. All network ports, splice points, connectors and drops shall be identified by means of placards identifying (inside ducts, raceways and plenums) those points along with necessary tool interface information including special tool part numbers as supplied by Contract.

**TS 10.1.1.1 System Requirement/DC to DC Converter or Options of an AC to DC Converter and/or a HVAC Inverter**

**Electrical Power Source Method and Implementation.**

The basic power generating elements shall consist of a fully isolated static converter(s) utilizing the traction system primary generation sources for necessary high voltage conversion to direct current (LVDC) applications.
The converter shall operate at its’ maximum efficiency and by incorporation and direct control, or equivalent interposing equipment means, of an additional converter for HVAC loads and utilization thereof, provide necessary supplemental power in order to ensure the basic constant voltage operation of the low voltage direct current systems @ 28 volts nominal maximum operating demand, with radiator and charge air cooling fans operating at coolant inlet temperature of 215°F. The system shall ensure by data acquisition and physical measurement, and necessary processing of the low voltage battery and LVDC power conversion equipment, the maintenance of constant voltage operation of the system, and where LVDC batteries do not recover (operate at or below temperature compensated current/time curves) the system shall identify and log to vehicle data acquisition systems defined as “Low Voltage battery Pack Charge Status.” Software and necessary interconnection equipment shall be provided that facilitates redefinition of PID’s and other programming elements needed to adjust system operation.

The vehicle primary low voltage system shall consist of a DC to DC converter that shall support all 12/24 DC loads. A single or discrete medium voltage inverter shall be arranged to operate under the general rules as applied to inverters/converters throughout this specification. Medium voltage inverter(s) for auxiliary service shall operate at 208/230 volts AC nominal and shall distribute 3 phase current to all assignable loads. Sinus wave distortion shall be minimized < 2% THD and active power factor and regulation correction shall be arranged.

Converter(s) shall provide increased and stabilized recuperative operation and shall by application improve overall vehicle efficiency. Converter’s shall by design, construction and proper application meet the maximum power requirements for said system at a rating of 120% of full load. The converter shall not meet its rise to rated temperature at greater than 80% of design rating when operating at 120 consecutive minutes maximum output. The converter shall provide full galvanic isolation of high voltage circuits. System converters/inverters shall be a J-1939 compliant or equal device open source data link. Where multiple discreet units are provided master/slave arrangements shall be hard wire programmed. It shall not be possible to interchange inverter for converter where applicable.

The converter shall in the Master Switch off position maintain a dedicated number of loads on virtual parallel bus for the following loads:

i.) AVL/AVM System
ii) Farebox and fare instruments data collection and transaction devices.
iii) Radio System
iv) Low Voltage Battery Equalization/supervision
v) Auxiliary Heater

The system shall time this off state mode of operation out after two (2) continuous hours of operation or upon necessary ESS SOC system protection shutdown.

An HVAC system inverter, if used, should supply all load requirements for the HVAC compressor and ventilation fan loads. The inverter shall incorporate a High Voltage Interlock Loop that prohibits operation when control or power cabling is disconnected from the system. Refer to § TS 9.8.1.1.

The inverter module(s)-groups shall be designed so that system and support components are logically arranged for efficient removal and replacement. All like modules shall be completely interchangeable and functionally grouped, as well as all interconnecting coach bars, connecters and terminals. Equipment weights that exceed 80# or 36kg, shall incorporate a lifting mechanism that facilitates component removal and replacement.
converter circuit control shall be arranged so as to prevent inadvertent propulsion system make-up and operation as well as the operation of converters encountering open, short circuited and other anomalous load conditions.

**TS 10.1.1.2 Reserved**

**TS 10.1.1.3 LVDC Battery Maintenance System**

The vehicle LVDC system shall be arranged with devices and a system of control and supervision required to obtain the following operational and systems maintenance conditions:

10.1.1.3.1 LVDC Battery Pack-Upon master switch set to OFF or night park or where master switch is not set to OFF but normal LVDC converter supervision is inactive due to propulsion inactivity/shut down the supplier shall arrange necessary capacity and supplemental charging required to affect the following outcomes and fully maintain battery pack SOC limits that shall ensure no damage to the battery pack system:

a.) System shall support loads with respect to standby time for all affected systems specified from §10.1.1.1 i-v and as required (including external signage for 15 minutes per cycle) in any discreet 24 hour period as follows:
   1. System shall monitor loads for data transfer activities as defined throughout the specification including all supervisory load requirements.
   2. A virtual electrical bus shall be arranged from multiplex implementation in order to minimize supervisory requirements.
   3. Upon data transfer completion standby or generally defined time out to transition from Standby to data transfer time periods completed, the virtual bus will cease operation and set to a state where load requirements are essentially parasitic (lowest possible operating load case) or otherwise mains LVDC battery connected.

b.) The system shall be arranged to monitor and control and direct supplemental charging from the traction ESS system in order to maintain specified LVDC SOC conditions. The system shall announce operation from the dash board by means of a visual indication or assigned flash pattern to prior installed lamp.

c.) The LVDC battery equalizer (EQ) shall effectively operate as a remote terminal unit (RTU). The EQ/RTU shall actively monitor and control all energy transfers, supervise load control as well as active and dynamic control of pack SOC/SOH levels.

d.) The RTU shall supervise and relay all control means required to determine ESS loan out limits. Upon ESS loan out limit obtained the RTU shall monitor and upon obtainment to LVDC battery pack programmed lower SOC limit obtained shall broadcast necessary CAN telegrams instructions required for orderly turn off of active systems.

e.) Upon conditions from § d.) this subpart obtained, and LVDC pack SOC lower limit obtained, the RTU shall operate a bi-stable or equal contactor (unlatch signal) where upon the contactor is arranged to break a single negative return wire as to effect total LVDC pack isolation (not RTU) required to preserve the minimal specified LVDC SOC level required to preserve necessary LVDC battery pack functionality and life extension. The contactor shall provide a manually resettable closing means.
The contactor reset shall be located at or near the engine compartment and it shall be accessible by a removable cover or means assuring access while providing an IP65 enclosure rating.

f.) In modes of operation defined by §10.1.1.3.1 the vehicle multiplex system shall shed all loads not required for the operating profiles defined by §10.1.1.3.1, a-e.

**TS 10.1.4 LVDC Chemistry**
The LVDC battery pack system shall be l-ion or equal based chemistry.

**TS 10.1.5 Voltage Regulation**
All voltage levels shall operate within the defined parameters and requirements for the units and systems involved and as to support the best overall reliable and efficient power delivery strategies.

**TS 10.1.2 Documentation**
The vehicle multiplex shall be configured to detect and store all illegal states of operation. The Contractor shall furnish a site license along with the vehicle program deliverable at the Pilot Bus Inspection. Site license shall permit program(s) to be modified without concurrence of the Contractor after the Warranty period. During the Warranty period SEPTA and the Contractor shall agree on all programming changes and the Contractor shall supply changes at no additional cost to SEPTA. SEPTA reserves the right to direct the Contractor to make changes during the Warranty period. The cost of any changes to be included in the Contract is delineated in Section 3 – Contract and General Conditions, GC 2.9 – Change Orders. In case of a dispute, refer to Section 3 – Contract and General Conditions, GC 4.2 - Disputes.

The Contractor shall supply a complete listing of all CAN telegram and binary switches in addition to the standard electrical drawing/schematics documentation.

**TS 10.1.3 Vehicle Monitoring and AVL Systems**
Coincident to the PILOT INSPECTION the Contractor shall provide documentation and shall demonstrate the type, class and features of integration attendant to the vehicle multiplex system and the vehicle ASAS, Card-AVL and AVM systems.

**TS 10.1.4 System Grounding**
The Contractor shall demonstrate by proper application and operation of all electrical systems and components that the electrical system is properly grounded and there exists a sufficient amount of redundant grounds to effect proper current return to any source in every system. Redundant grounds are required on all circuits except where it can be demonstrated to SEPTA that this is impractical. The vehicle frame may be used as a current return source, provided there exists no drop in voltage greater than 50 millivolts on any system with the exception of the starter circuit. Electrical system grounds shall not pass through hinges or bolted joints, no main or through wiring harnesses shall be located below the floor level. All lighting shall use redundant grounds. The Contractor shall ensure that proper grounding and shielding is provided and that utilities referenced to ground do not cause interference with shielded systems.

**TS 10.1.5 System Protection**
The electrical system shall consist of wiring of sufficient ampacity to provide for proper system performance and fuses or circuit breakers designed to properly protect the system from overloads and to prevent overheating and
fires. ATC fuses where utilized shall be standard ratings/fuses above 30 amps may be Contractor specified. If circuit breakers are used they shall be the manual reset type, conforming to the SAE J553 and J1625 protocols, if fuses are used they shall be the ATC automotive type, conforming to the SAE J1888 protocol. If electric start is used it shall be exempt from the fusing requirements of this section, however any electric starter presented by the Contractor shall be the thermal over-load protected type. The thermal circuit shall disable the starter when an overheat condition is detected and a method of monitoring that point failure shall be provided for if a vehicle multiplex system is employed.

**TS 10.2 Modular Design**

The design of the electrical system shall be modular so that each major component, apparatus panel or wiring group is easily removable for service and repair with standard hand tools or by means of connectors. The power plant wiring shall allow for the complete removal of the power plant by means of environmentally sealed modular disconnects. No point to point disconnect of power plant wiring or wiring pullback shall be permitted.

**TS 10.3 Wiring and Terminals**

All wiring between major electrical components and termination, except battery wiring, shall have double electrical insulation; shall be waterproof and petrochemical non-reactive; and shall meet the requirements of the SAE J1292 and J1128, type SXL, latest version of practice for Motor Coach and Low Tension Cable Insulation. GXL or TXL insulation shall be acceptable substitutions where applicable. Except where interrupted by a switch or other disconnect means all cabling shall be terminated by connections using bolted or screwed terminations. All wiring shall be grouped and numbered at intervals no greater than six (6) inches. The wiring shall be color coded, or marked in a manner requiring SEPTA approval, for their full length termination to termination. The wiring shall be at all times and locations properly mechanically supported by means of insulated clamps that are mechanically secured to the vehicle. Clamping method(s) and material shall be subject to SEPTA's approval at the PILOT INSPECTION.

If the Contractor can demonstrate an alternate method of attachment that is a systemic equal for the life cycle of the coach, SEPTA shall evaluate that system on the approved equal basis. All wiring harnesses greater than five (5) feet in length and five (5) wires per harness shall include a spare ratio of ten (10)% minimum wiring capacity. The resident spares shall be equal to the largest wire gauge in the wiring harness, battery cabling excluded. Wiring harnesses shall be designed to avoid transmission of differing voltages whenever possible. If a wiring harness is required to supply different voltage potentials in the same harness than the wiring must provide sufficient dielectric and mechanical properties as to preclude the failure or loss of insulation in that harness. The requirement for double insulation shall be met by the sheathing of all wires and harnesses with a non-conductive, flexible conduit. Grommets of elastomer material shall be provided at points where harnesses penetrate structures, bulkheads, cable raceways and other structures that are not points of termination. Wiring supports shall be non-conductive.

Precautions shall be taken during the system assembly and the vehicle build process to protect all wiring from heat, water, solvents, excess mechanical strain and other possible sources of damage. All wiring shall be of sufficient length to permit maintenance personnel to pull back and reterminate twice, except where the Contractor can demonstrate that the practice not effective, subject to SEPTA’s approval at the PILOT INSPECTION.

**TS 10.3.1 Wiring Termination**

All wiring terminations shall be of the highest quality available in the trade. The Contractor shall demonstrate compliance to the requirements of this section by submission of a “bill of material”, or other certification means, that (the Contractor), has tooling of the type and quantity sufficient to effect the production of the number(s) of
buses governed by this Contract. A “bill of material” shall be supplied with the PILOT INSPECTION bus for all installed plugs, wiring harnesses, and other electrical connectors. All termination points/fasteners shall face in an outward direction that permit full access for service.

**TS 10.4 Junction Boxes**

All modules, relays, contactors, controllers, switches, circuit protection devices, and other electrical equipment shall be located and secured in easily accessible junction boxes/equipment cabinets or boxes. The boxes shall be sealed to prevent the entrance of water and other contaminants that could adversely affect the proper operation of the electrical system. Any junction box(es) located in areas outside of the coach interior shall be sufficiently sealed to prevent the water or debris that would be forced in by high pressure washing or steam cleaning. All junction boxes shall be completely modular and all internal components shall be labeled for ease of location and identification. The labeling shall be coated to prevent degradation due to oil and grease contamination. If switches are mounted at the rear junction box they shall be water and dust proof, further, the “rear run/front run” switch function shall isolate those functions directly, outside of the multiplex function. All switches and plugs shall be properly and indelibly labeled.

**TS 10.5 Electrical Components**

All electrical components, including switches, relays, circuit breakers, wiring harness connectors, and data and information system connectors, shall be of a heavy duty design. Sockets of plug-in components shall be polarized where required for proper function, and the components shall be positively retained. Electric motors, controllers, contactors and modules shall be located in a manner that does not require the removal of other components in order to gain access. All low voltage DC motors shall be electrically-commutated type. Catalog cuts shall be submitted for all electrical equipment the Proposer intends to supply.

**TS 10.6 Multiplex Wiring System**

**TS 10.6.1 General**

A vehicle multiplex system shall be provided. The system to be provided shall meet or exceed all relevant performance aspects of the point to point wiring (Class A) that the system intends to replace.

The multiplex system shall be self-supporting at the maintenance diagnostic level. There shall be no PC interface required to perform all maintenance level activities. The system shall not be reconfigurable at the maintenance support level. The system shall be fully programmable and reconfigurable by PC supported platform or proprietary tools at the Engineering support level. The multiplex system shall be equipped with an E²Prom memory or a battery/Ucap energy storage means that permits RTC and other timing functions to process for 168 hours. Upon dead restart, the multiplex system shall prompt the maintainer to make all necessary system resets.

**TS 10.6.2 General Multiplex System Function**

The general structure of the multiplex system should be the implementation of the class A aspects with class B aspects as a functional superset of class A. This feature should provide the utilization of the data bus for both class A and B with the alternate configuration of both data buses for “gateway” devices. In a similar manner the class C data bus is intended to be a functional superset of the class B system. All terms and system descriptions used by Contractor shall be those terms and definitions as referenced and defined by the SAE J-1213/1. If a proprietary system or term(s) are offered, those terms shall be defined to the satisfaction and approval of SEPTA. The multiplex system shall communicate using J-1939 standards and shall through put and otherwise eliminate other parallel data back bones.
TS 10.6.3 System Modules and Data Wiring
All modules, gateways, data cable tie points and other hardware constituting the data and power distribution system shall be of heavy duty rated construction. All system components shall be placed in order to facilitate proper operation, ease of monitoring and display, and ease of replacement. All system components shall be “plug and play” Type systems that do not require external point programming.

TS 10.6.4 Multiplex System Performance Requirement
The multiplex system shall be able to meet or exceed all relevant performance aspects of point to point wiring, class A. The system shall have the capability to move parametric data from gateway to gateway in order to reduce the amount of information nodes and sensor points to the minimum required to effect proper and reliable operation of the vehicle, class B. Gateways shall be configured to the SAE J-1850 practice except where the Contractor can demonstrate to SEPTA’s satisfaction, at the PILOT INSPECTION, that a proprietary gateway is of superior functional and cost advantage to SEPTA. The system shall have the ability to transfer data at real time speeds, as defined by J1939 practice internally, and from gateway to gateway points and system to gateway points, class C.

At any failure to a node or point that the system has the capability to monitor or control as defined by configuration/programming, the multiplex system shall be designed to monitor and record that failure. Said failure recognition shall be stored in a non-volatile format that can be accessed by maintenance personnel via diagnostic tool(s). Failure information may be exported to 3rd party device. The system shall be configured to provide a read out capability and documentation. The system shall be configured to operate a self-test routine that checks all defined points of operation at vehicle start up, or upon a manual demand.

TS 10.6.4.1 Hardware Requirements
a) INTERFERENCE and COMPATIBILITY

The multiplex system shall control and be immune to all radiated and conducted emissions, magnetic and electrostatic. Verify at Pilot Inspection.

b) ENVIRONMENTAL REQUIREMENTS

Equipment providers shall meet or exceed the requirements for heavy duty electronic equipment as defined by the SAE J-1455 recommended practice. All data and power control cables shall be environmentally sealed by means of approved connectors or through environmental seals were wiring exits or enters modules, gateways devices or power conditioning modules. PILOT INSPECTION Item.

c) INPUT/OUTPUT-POWER CONTROL MANAGEMENT

All input or control switches shall be sourced and configured in a common configuration. All input modules shall provide status indication for switch status. All output modules shall provide indication for output continuity, output status, open fuse and/or open circuit breaker indication. All fuses or circuit breakers shall be readily accessible for repair or replacement. Where interposing relays are required, the fuse protection rating shall be adjusted for relay burden. All circuit breakers shall be located adjacent to their control modules. The modules shall be configured to provide control circuit to bus common circuit isolation to a Common Mode Rejection of 1.5 K volts per μS @ VCM = to 600 volts min. Power conditioning shall be provided either at the discreet modular level or as a separate module. The Contractor shall demonstrate power supply conditioning and transient protection through testing.
conducted at the PILOT INSPECTION, and said testing shall require SEPTA’s approval. The multiplex power conditioning unit shall prevent vehicle power supply system generated events from causing malfunction(s) to the multiplex control system. The Contractor shall demonstrate this through actual transient/subtransient noise generation testing procedures at the PILOT INSPECTION. The test and methodology shall be submitted to SEPTA before the delivery of the PILOT INSPECTION VEHICLE for approval. The power module shall provide all control and supervisory power for the multiplex system. The power supply module shall be capable of full dynamic electrical system isolation between the vehicle systems and the multiplex system(s). The power supply system shall permit proper operation of all affected systems at inputs from 10 to 36 volts DC.

d) DATA LOOP WIRING

All wiring constituting the data loop shall meet or exceed these physical and performance characteristics:

i) Heavy-duty Deutsch, Packard, AMP CPC connectors with strain relief. The Contractor shall submit a full bill of material including shells, receptacles pins, strain-reliefs, and all necessary installers, extractors and hand presses needed to maintain these components.

ii) Data loop wiring shall be properly supported with no excessive bends or offsets. Data cabling shall not interfere or be attached to “other” cables, conduits, hoses or other removable objects.

iii) Data loop cable shall be plenum-rated, 125 degrees C min., NEC 725-38(b) and UL class 2 power limited, 125 volt cable. Cable shall pass UL 910 flammability test minimum. Cabling supplied shall meet or exceed all ballistic requirements for the selected communication data rates.

iv) Data loop cabling shall be loomed and labeled for identification. Placards shall be visible in every location there exists a module or control panel. The placards shall provide information sufficient to allow maintenance personnel to identify module, circuit, wiring, fuse/circuit breaker, power and data coach detail(s).

v) The Contractor shall perform a TDR or equal ballistic test for all data loop systems. The testing shall measure logical states, packet drop out and other pertinent information. The test shall be witnessed by a member of SEPTA’s Automotive Engineering group and the results if acceptable, shall be made available to SEPTA as a Contract deliverable and maintained by the Contractor as a baseline for other production coach tests.

vi) The Contractor shall obtain a SEPTA approved independent contractor to test, certify and approve all network CAN, LIN and proprietary network’s physical layer and network integrity at the Pilot Vehicle Test. Testing shall be full stress, dynamic and shall ensure that all transceivers and like equipment operate within applicable standards in order to verify that all systems shall perform as design for their intended service. All physical layer elements shall operate within proper ballistic characteristics. All system voltages and waveforms shall meet applicable standards.

TS 10.7 Batteries

TS 10.7.1 Battery Performance-
a) Reserve Capacity (30Ah test) = 180 minutes to Traction SOC limit + 90 minutes to LVDC pack SOC preservation limit.

b) Twenty Hour Test = 1.9Kw to Shutdown

c) Charge Acceptance = Dynamic

d) Voltage = nominal rating = 12/24 VDC

e) Test Certification: = From Approved Test Plan.

f) Peukert Capacity = Performance test minimum and maximum system discharge.

**TS 10.7.2 Battery Tray Construction and Serviceability**

Batteries shall be readily accessible for inspection and serviceable from the outside of the vehicle. The batteries shall be securely mounted in a draw-out, locking tray. The tray shall be constructed of stainless steel of a type sufficient to ensure its function and structural integrity for a minimum of 12 years. The tray shall be retained in its stowed position utilizing a captive locking pin. The tray mounting points (tray to chassis) shall be protected from galvanic corrosion. The tray shall be designed to allow the battery fill caps to be accessed without interference from any part of the vehicle. When the battery tray is in the drawn-out position, the construction of the tray shall be sufficiently rigid to properly support the weight of the batteries and cabling. Battery cables shall be arranged to permit draw-out without cable interference. The battery cabinet shall be constructed in a manner that precludes it from deteriorating for the expected life of the vehicle. Battery hold downs and retaining structures shall be fabricated from non-metallic, Delrin™ or equal material that precludes cable shorting or other shunting currents. All cabling passing through or between cabinets, enclosures, bulkheads or like structures shall be handled in a way that precludes short circuiting or grounding to the aforementioned structure, subject to SEPTA approval at the PILOT INSPECTION.

Battery pack cabling shall be controlled by a flexible tray cable arranged upon a loop that supports and prevents cable damage whilst the tray is stowed or deployed for battery service.

Jump-start connector shall be provided in the engine compartment equipped with dust cap and adequately protected from moisture, dirt and debris. See Section TS 11.24 for details on type of connector required.

**TS 10.8 Master Battery Isolation Switch**

Single disconnect switch(s) shall be provided that will isolate the battery(s). The switch shall be configured to totally isolate the batteries from the rest of the vehicle systems. The battery disconnect switch shall be connected to the battery posts directly, (electrically). The battery posts shall provide only the termination points required to electrically connect the batteries to the switch. SEPTA shall not permit the battery posts to be used as junction points for any other electrical system tie points, other than those specified in this section. Therefore, the battery cabling shall be as follows: 1-24 volt cable, 1-12 volt cable, 1-ground cable and a series jumper cable. The wiring for the battery circuit shall conform to applicable sections of the SAE J1127 protocol. The wiring for the starter circuit shall be continuous except where interrupted by the battery disconnect switch. Non-equipotential cabling shall not be developed and/or clamped conductively in a manner that presents shorting or grounding occurrences. The wiring for the battery circuit shall conform to the SAE J541 protocol for Voltage Drop for Starter Motor Circuits. Normal and/or emergency operation of the battery isolation switching (opening) shall cause immediate vehicle systems shut down and the shut downs occurring from the switch operations shall not damage any operating system, converter or vehicle utility.
TS 10.9 Automatic Fire Suppression System (AFSS) and Manual Extinguisher

The Contractor shall furnish a fire extinguisher to be equipped with I.C.C. type capacity gauge. The fire extinguisher will be mounted at the left side of the operator seat or other location within the driver’s area, out of the reach of passengers and shall require SEPTA’s approval at Pilot Inspection.

In addition, an approved automatic fire suppression system shall be installed in the engine compartment. The Contractor shall furnish an applications matrix outlining the installation criteria used to determine the efficacy and utility of the proposed fire suppression system coincident to the PILOT INSPECTION.

TS 10.9.1 Automatic Fire Suppression System (AFSS)

An automatic fire suppression system shall be arranged to provide basic passenger protection and detect, control, suppress and limit vehicle damage.

A manual discharge switch shall be located with reach of the driver from a seated position. The switch shall require three separate actions in order for operation:

1. break seal.
2. lift cover.
3. push button.

The suppressant system shall be capable of operating (making suppressant delivery, no data logging or ancillary features) without primary electric power sources.

If located inside of cabin duct ways, suppressant charge bottles shall be arranged with a Plexiglas window that permits the suppressant level gauges to be viewed without removal of said window fixing screws. The aforementioned window shall permit an inspection of the solenoid or actuating device wiring connections, with spot inspection lamp switch located at the AVL/M cabinet.

The AFSS shall be arranged to detect and direct the application of suppressant to specific defined vehicle locations/zones.

The AFSS shall detection supervision shall consist of two (2) zones as defined by APTA-BTS-RP-003-08:

a. Engine/drive line compartment
b. Emission Module compartment

Zones defined as 1-a &b shall be protected through either separate or manifold ported delivery systems at 25 lbs of suppressant or equal, each zone.

The Contractor shall demonstrate the utility of, and correctness in application of, all components related to the automatic fire suppression system. The Contractor shall demonstrate that their detection sensors, monitoring and delivery system shall operate when required, and under all operating circumstances. The suppressant container shall be arranged in a way that facilitates reliable operation and ease of maintenance. The suppressant storage container shall be equipped with a gage indicating status of charge. The Contractor shall certify that all delivered vehicles have undergone testing sufficient to achieve effective and reliable operation.

A distributed wire type or alternate lineal and optical infrared sensor detection system shall be provided for zones. They shall be located in the engine compartment under all horizontal bulkheads, above and downwind of the major heat sources, and in areas likely to be wetted by leaking flammable fluids. Detection lineal sensors shall be scalable in terms of temperature offset values that provide a means to compensate for various heat reject rates/sources. Additional branched sensors shall be located in other potentially critical areas. The sensors shall
detect over-temperature in the critical areas and shall activate the fire alarm bell and warning light in the driver's compartment.
Suppressant delivery nozzle(s) shall deliver agent at no less than 180° coverage.

The Fire Suppression System, both independent zones a & b, in automatic mode shall operate as follows:
1. After activation of the primary fire extinguisher the fire detection system shall continue to monitor the hazard(s). If the detection system continues to see an abnormal temperature the Driver Display shall flash “FIRE – STOP VEHICLE” The Display shall then read “ENGINE SHUTDOWN -15 seconds. The displays timer shall countdown and the audible alarms frequency shall increase until countdown reaches 0 seconds. At the end of the countdown or when a signal is received that the vehicle is stopped, the secondary extinguisher shall activate and the engine shall shutdown.
2. Cease operation of HVAC compressor and all forced ventilation first (1st) stage activation.
3. Cease operation of all primary propulsion and auxiliary cooling fans-equip first (1st) stage delivery, systems stay active if operator overrule switch set.

Salient Characteristics for Sensor/Detection Wiring

Sensor wiring shall be capable of continuously monitoring the hazard(s) of over-temperature.

The sensing element shall have a twenty (20) year service life.

No cleaning, calibration or inspection shall be required.

The circuit can successfully suppress a false fire-warning signal upon the occurrence of even a rapid occurrence of intermittent shorts. Yet permit a true fire warning signal if the change in resistance is due to even a “fast” fire, such as produced by a very hot torch-like fire impinging on the sensing element.

TS 10.10 SEPTA KEY Payment Technical Requirement

General
The Contractor shall arrange for the installation of Septa Key payment technology equipment. The Proposer shall furnish Septa a conformed bill of material and drawings for approval submission due at proposal. The Contractor shall obtain all required system documentation from Xerox/ACS.
The Contractor shall furnish a commissioning plan including all physical, software and sundry elements and systems required to affect a complete and correct operating system at Pilot and production deliveries.
All units, cabling and sundry hardware shall meet requirements specified herein and by §9.9.4.4.
The affected areas as follows:

TS 10.10.1 Cabling
Cabling specification and drawings shall be sourced by the Contractor from Xerox/ACS.
Four (4) major harness deployments are required:
a.) OBP and Farebox cable-located at Farebox W/integrated and terminated 1708. Includes all bushings and strain reliefs from Xerox BOM.
b.) OBP Cable from the modem remote rear door area W/integrated and terminated 1708. Cabling to be placed stored serviceable condition in the rear door machinery space.

c.) Under Dash Cable.

d.) Modem Power Cable.

TS 10.10.2 Modem
The Contractor shall source applicable units as specified from Xerox/ACS. The modem shall be mounted and unobstructed for service, replacement and repair. The modem shall be powered from a stabilized noise immune source.
The power supply shall be battery connected.

TS 10.10.3 Antenna
The Contractor shall install a cellular based antenna per specification from Xerox/ACS. The antenna installation shall follow the rules for installation attending all exterior antennas.

TS 10.11 Radio Noise Attenuation
Proper radio noise suppression equipment shall be provided to eliminate conducted and radiated emissions.

TS 10.11.1 Radio/Fare Collection System/Auxiliary Device

TS 10.11.1.1 Radio Power
The Contractor shall supply an electrically clean source of power for the radio electronic system, the wiring shall be sized for 30 amperes @ 13.8 volt DC, max. The circuit protection rating shall be fifteen (15) amperes. The system shall have redundant grounding.

TS 10.11.1.2 Fare Collection System
The Contractor shall supply an electrically clean source of power for the fare collection system, the wiring shall be sized 30 amperes @ 13.8 volts DC Max. The circuit protection rating shall be 10 amperes. The system shall have redundant grounding. The Contractor shall install a mounting plate, quick release hardware and power plug as described in attachment to § 6; Technical Specification.

TS 11. Attachment to Section 6, Technical Provisions

TS 11.1 General

TS 11.2 Definitions:

(a) Design Operating Profile Refer to § TS 2
(b) Class of Failures Refer to § TS 2
(c) Maintenance Personnel Refer to § TS 2
TS 11.3 Overall Requirements

TS 11.3.1 Maintenance and Inspection Equipment - Any special tools required to maintain the bus shall be provided in quantities as specified in Attachment to Section 6: Technical Specifications. Additional requirements for Maintenance and Inspection Equipment are also provided in these attachments.

NOTE: List summary for convenience of Proposer, omissions to list do not relieve proposers from specification compliance.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compartment access door keys (5/16&quot; square key) Tool shall be</td>
<td>2 per bus</td>
</tr>
<tr>
<td>equivalent to Bondhaus model #13313 utilizing 5/16&quot; square stock bar</td>
<td></td>
</tr>
<tr>
<td>Radio Box Key (#CH751)</td>
<td>2 per bus</td>
</tr>
<tr>
<td>Front destination sign compartment cover key (Southco 29-90-215-10)</td>
<td>2 per bus</td>
</tr>
<tr>
<td>Hoist Adapters</td>
<td>10 sets</td>
</tr>
<tr>
<td>Towing Bars/adapters</td>
<td>10 sets</td>
</tr>
<tr>
<td>Jacking adapters</td>
<td>10 sets</td>
</tr>
<tr>
<td>Break out boxes for Propulsion systems (all system elements, engine,</td>
<td>10 sets</td>
</tr>
<tr>
<td>inverters, converters, controllers)**</td>
<td></td>
</tr>
<tr>
<td>Battery Pack removal Tool (Septa Spec)</td>
<td>12 sets</td>
</tr>
<tr>
<td>Propulsion system proprietary tools, includes all adaptors, break</td>
<td>08</td>
</tr>
<tr>
<td>out and test fixtures, include all overhaul of drive unit, Battery</td>
<td></td>
</tr>
<tr>
<td>pack, controllers**</td>
<td></td>
</tr>
<tr>
<td>Engine tune up kit including belt tension gauge, seal installers/</td>
<td>05</td>
</tr>
<tr>
<td>removers, injector timing gauge, valve lash gauges, etc.**</td>
<td></td>
</tr>
<tr>
<td>407c Hermitic HVAC System tools, charging stations, (2 each</td>
<td>12</td>
</tr>
<tr>
<td>refrigerant containers per station)</td>
<td></td>
</tr>
<tr>
<td>Rear Differential proprietary Tools**</td>
<td>12</td>
</tr>
<tr>
<td>Wheel end/hub service tools**</td>
<td>12</td>
</tr>
<tr>
<td>Disc Brake proprietary Tools and gauges**</td>
<td>14</td>
</tr>
<tr>
<td>Diagnostic readers for HVAC system**</td>
<td>30</td>
</tr>
<tr>
<td>1st Year Laptop Computer Kits for troubleshooting of the multiplex</td>
<td>29</td>
</tr>
<tr>
<td>system as specified in TS 11.4.1</td>
<td></td>
</tr>
<tr>
<td>Camera Laptop as specified in TS 11.4.1</td>
<td>01</td>
</tr>
<tr>
<td>CAN Software Kits (Vector CAN 1939/1708) and connecting cabling.</td>
<td>08</td>
</tr>
<tr>
<td>Installed for Engineering PC’s (4 Kits in 1st Year, 4 Kits with</td>
<td></td>
</tr>
<tr>
<td>Hardware/Software refresh in 4th Year of Contract).</td>
<td></td>
</tr>
<tr>
<td>4th Year Laptop Hardware/Software Refresh Kits as specified in TS</td>
<td></td>
</tr>
</tbody>
</table>
11.4.1
Electric Cooling Fan control emulation, connection cabling, etc.** 29
Battery High Voltage Tools Set 14
Fuel Focus Test equipment (Maximus Model # KBX-MT-03-MAX) (TS 7.7.3.7) 08
Emissions, Unit/DPF/Reactor Tube/SCR or Unitized System Shipping Containers 60
Tablet Computers & Hotspots for Inspection Process (QA 1.2.2.1) 08
IVS Boundary scan tools for all system elements (TS 9.9.7.16.6) 06 per System

*Fractional quantities shall be rounded up to nearest whole number
** No Bidder or Proposer’s submission shall be considered qualified until the following conditions are met:
e.) Submission of complete parts and maintenance catalogs with specific product application
f.) Submission of complete tool lists for product confirmed to be complete from the product supplier

TS 11.4 General PC Hardware

TS 11.4.1 All service kits shall be complete and ready for service upon delivery.

The Contractor shall furnish twenty nine (29) laptop computers needed to provide complete engineering, training and maintenance diagnostic support. The laptop PC’s shall be integrated in to twenty nine (29) maintenance kits consisting of all devices required to affect operation of application to vehicle equipment housed in suitable Pelican™ type hard cases-service kits. The service cases/kits shall be arranged with die cut compartments designed to accommodate various inter-connect devices, cables, connectors and operating instructions. The service cases/kits shall have appliqués affixed to the upper pallet or shell that provides a complete inventory of items supplied by said cases/kit, along with application software URL’s and service desk telephone numbers.

All Cummins Engine software requiring annual or periodic renewal shall be supplied by the Contractor for twelve (12) years and said service shall be part of the base bus bid.

One each of configuration as specified by TS 11.4.2 a through c shall be delivered coincidently with the PILOT INSPECTION Vehicle.

At the start of delivery year four (4) or the final year of delivery-the Contractor shall deliver twenty nine (29) additional laptop PCs including revised and current generation software under the same configuration requirements specified herein sans hardware and Pelican Cases.

The Contractor shall provide a laptop PC that is suitable and capable to verify the operation of the camera placements and completed system functionality.

The PC shall be delivered (Verified by Contractor Letter to be fully functional) 60 days from contract NTP.
The laptop computers shall be delivered as part of a service kit defined herein, the laptop computers shall have all programs, applications and operating systems installed, tested, and verified fit and ready for intended service upon customer receipt.

The Laptop computers shall be Panasonic Toughbook CF-53 or equivalent. The PCs shall be fitted with the maximum RAM capacity installed. The hard drive shall be 256 megabyte SSD type min. The Contractor shall furnish a drive image to SEPTA’s Bus Engineering department defining configuration. Each PC shall be equipped with a standalone charging unit with one (1) spare battery.

The Contractor shall furnish a master list on Excel Spreadsheet indicating the following:
1.) The PC serial number
2.) The PC OS system license information
3.) Hardware supplied with kit
4.) All software and version numbers, expiration data
5.) Check off sheet indicating what application software is applied to vehicle systems
6.) System operational check sheet data

TS 11.4.2 PC Configuration and Delivery for Service Condition
All laptop PC’s delivered pursuant to Contract shall be delivered in a condition of complete readiness for the service intended and as specified by delivery schedule. All PC hardware, OS and application software and interface devices shall be fully functional and all said units shall be supplied with a certification pursuant to the requirements as defined by § SP 1.1

All Laptop PCs shall be configured with administrative protocols, password protection as defined by SEPTA’s Bus Engineering department. Said measures shall not be disclosed to any other person or parties without the express written permission of the Manager of the Bus Engineering department or their elects.

The Laptop PCs shall be delivered in three (3) levels of programming configuration:

a. Five (5) (Numbered ENG_1 through 5) Engineering Level-Includes all software required to program, adjust and maintain specified units and systems. These Pcs shall be equipped with Vector Corp., CAN J1939 analysis software. Additionally, four (4) Vector CANLOG4 tools and required interfaces shall be furnished with Microsoft Office shall be provided. The Contractor shall supply compete DBC files for all transacted (common busing) vehicle and systems interfaces. The Contractor shall fully arrange the Canalyzer, hardware, interconnecting cables, software and DBC files and labels for data and network structures and data files so as to enable complete online functionality with no configuration required from the customer.
Microsoft Office Professional including, Adobe Professional, MS Project, MS Vizio.
The Contractor shall furnish two (2) portable model boards that shall emulate a complete and be a functionally complete data bus representation for the vehicles specified and delivered herein. There shall be sufficient nodes arranged as to simulate variable bus loading up to the maximum as defined by J1939 standards.
The models shall be arranged through a PC interface so as to permit complete data traffic management and bus loading.
The models shall be effectively a ballistic equal to the vehicles furnished under this specification. The units shall be sufficiently portable as to be hand carried. Additional details shall be furnished via Addendum.

b. Two (2) (Numbered Training 1 and 2) Training Level-Includes all programs required for training purposes, not programming. Microsoft Office Professional including, Adobe Professional, MS Project, MS Visio.
c. Twenty Two (22) (Numbered 1 through 22) Maintenance Level - Includes all programs required to engage diagnostic strategy pursuits, maintain, but not program, adjust, alter or otherwise modify programming conditions, parameters and all other attending circumstances. Microsoft Office Professional and Adobe Reader shall be provided.

**TS 11.4.3 Software**

All software supplied pursuant to this Contract shall provide complete functionality of current and future PC systems for a period of 12 years or 500,000 miles. The Contractor shall furnish all single, multiple site, open share(ed) and other license agreements at laptop Pc service cases/kits delivery. Software requiring renewal fees and those that have a limited calendar life, operational cycle life dependent rendering, said software limited and/or otherwise non-function, shall be supplied on the necessary periodic basis-for 12 years or 500,000 miles in quantities identical to the initial PC hardware/software application program configuration.

Software shall be supplied for the following systems:

- Engine and Emission Module supplier (if not fully integrated into engine software)
- Fuel Focus
- Propulsion supplier, all system elements. Note: where Allison system is supplied, software shall be universal Allison for hybrid and mech-hydraulic systems
- Traction battery if not an integrated propulsion system feature
- HVAC system
- HVAC, Auxiliary fans with controllers
- Electrical Multiplex system (engineering/programming and maintenance levels)
- Integrated information system/dash display system
- ATC/ABS supplier
- Vapor Class system
- Auxiliary Heater system
- Lighting system (non mux integrated)
- LVDC and medium voltage auxiliary converters
- Auxiliary electric fan cooling system (all sub-controllers)
- Camera system software
- Disc brake software
- Auxiliary Heater
- Dash displays and Diagnostic data displays
- All systems furnished by the Contractor in support of a fully configured as built vehicle.

The Proposer(s) shall specify an application matrix defining the total number(s) and types of software and licensing attending the proposed vehicle.

**TS 11.5 Generic Instruments and Equipment**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluke 124/003s Meter kits</td>
<td>12</td>
</tr>
</tbody>
</table>
TS 11.6 Interior Noise Test Procedure

A MEASUREMENT OF INTERIOR SOUND LEVEL OF TRANSIT BUSES

I. INTRODUCTION
This specification will establish the test procedure, environment and instrumentation for determining the maximum sound levels for transit buses in their normal mode of operation. This procedure shall meet the requirements for interior noise level measurement as proposed by the SAE Bus Interior and Exterior Noise Measurement Subcommittee * on 05/09/75.

II. DEFINITION
A transit bus (bus) shall be defined as an on-highway motor vehicle designed specifically to transport 11 or more passengers. Not included are station wagons and multi-purpose vehicles.

III. INSTRUMENTATION
The following instrumentation shall be used, where applicable, for the measurement required.

- A sound level meter which meets the requirements of the International Electrotechnical Commission Publication 179, Precision Sound Level Meters, and ANSI S1.4 (as revised) - 1961, General Purpose Sound Level Meters.
- As an alternative to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or indicating meter provided that the system meets the requirements of SAE J184 (as revised).
- A sound level calibrator (See Paragraph VI-C: 3).

IV. TEST SITE
A. A suitable test site shall consist of a level, open space free of large reflecting surfaces such as parked vehicles, signboards, buildings, or hillsides located within 50 feet of the test vehicle.

*There is no existing SAE procedure to define interior noise measurement procedure for transit buses.

B. The tests are to be conducted on smooth, dry concrete, or asphalt road surfaces.

The ambient sound level, including wind effects, which may come from sources other than the vehicle being measured, shall be at least 10 dB lower than the level of the tested vehicle.

V. PROCEDURE
A. Sound levels within the bus shall be measured with all doors and windows closed and all vehicle equipment in operation. If some equipment operates on a cyclic basis, the sound level shall be measured with all equipment functioning simultaneously to determine the worst-case noise level.

B. Measurements shall be made with the vehicle empty except for test personnel and equipment. Not more than three persons shall occupy the vehicle during the measurements.

C. Measurements shall be made at a height of four (4) feet above the floor and directly above the center of gravity of the buttocks at locations corresponding to the following:

1) The rear most seat at the centerline of the bus.
2) The seat nearest the center of the bus and at the bus centerline.
3) The foremost passenger seat; at the centerline of the bus.

D. Accelerate the bus at full throttle from standstill to 35 mph. Maximum sound level during this operating mode must be observed.

E. Measurements

i The sound level meter shall be set for "fast" response and for the A-weighted network.
ii The meter shall be observed while the vehicle is proceeding according to Paragraph V-D.
iii The sound level recorded shall be the average of at least four (4) readings.

VI. GENERAL COMMENTS

A. Measurements shall be made only when wind velocity is below 12 mph.

It is required that technically trained personnel select equipment and that tests are conducted only by qualified personnel trained in the current techniques of sound measurements.

B. Proper usage of all test instrumentation is essential to obtain valid measurements. Operating manuals or other literature furnished by the instrument manufacturer should be referred to for both recommended operation of the instrument and precautions to be observed. Specific items to be considered are:

1) The effects of ambient weather conditions on the performance of all instruments. For example: temperature, humidity and barometric pressure.
2) Proper signal levels, terminating impedances, and cable lengths on multi-instrument measurement systems.
3) Proper acoustical calibration procedures to include the influence of extension cables, etc. Field calibration shall be immediately before and after each test sequence. Internal calibration means are acceptable for field use provided that external calibration is accomplished immediately before or after field use.
C. Vehicles used for tests must not be operated in a manner that would cause violation of the break-in procedure specified by the manufacturer.

VII. REFERENCES

A. Suggested reference material is as follows:
   o ANSI S1.1-1960 Acoustical Terminology
   o ANSI S1.2-1967 Physical Measurement of Sound
   o ANSI S1.4-1961 General Purpose Sound Level Meters
   o IEC Publication 179, Precision Sound Level Meters

B. Applications for copies of these documents should be addressed to the following:

   The American National Standards Institute, Inc.
   1430 Broadway
   New York, N. Y. 10018

NOTE: It should be recognized that variations in measured sound levels may occur due to variations in the test site, differences in temperature, differences in test equipment, and inherent differences in nominally identical vehicles.

TS 11.7 Exterior Noise Test

MEASUREMENT OF EXTERIOR SOUND LEVEL OF TRANSIT BUS

I. INTRODUCTION

A. This specification establishes the test procedure, environment and instrumentation for determining the maximum exterior sound levels for transit buses in their normal mode of operation.

B. This procedure meets the requirements of SAE Standard J-366b as proposed for modification by the SAE Bus Interior and Exterior Noise Measurement Subcommittee * on 05/09/75.

II. DEFINITION

A transit bus (bus) shall be defined as an on highway motor vehicle designed specifically to transport 11 or more passengers. It shall not include station wagons and multi-purpose vehicles.

III. INSTRUMENTATION

The following instrumentation shall be used, where applicable, for the measurement required.

A. A sound level meter which meets the requirements of International Electrotechnical Commission Publication 179, Precision Sound Level Meters, and ANSI S1.4-1961, or approved equal, General Purpose Sound Level Meters.

B. As an alternative to making direct measurements using a sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or a graphic level recorder or indicating meter, providing the system meets the requirements of SAE J-184.

C. A sound level calibrator (See Section VI.C.3)
* As published, the SAE Standard J-366b (as revised) - EXTERIOR SOUND LEVEL FOR HEAVY TRUCKS AND BUSES, is not acceptable to transit bus operation mode.

D. A microphone windscreen may be used provided that its effect on the microphone response is not more than ± 1dB for frequencies of 20 - 4,000 Hz, or 1 1/2 dB for frequencies of 4,000 - 10,000 Hz.

III. TEST SITE

A. A suitable test site shall consist of a level open space free of large reflecting surfaces such as parked vehicles, signboards, buildings, or hillsides located within 100 feet of either the vehicle path or the microphone.

B. The microphone shall be located 50 feet from the centerline of the vehicle path and four (4) feet above the ground plane. The normal to the vehicle path from the microphone shall establish the microphone point on the vehicle path.

C. An acceleration point shall be established per Section V.

D. The end zone shall be the area beginning at 10 feet and terminating at 30 feet beyond the microphone point.

E. The measurement area shall be the triangular area formed by the variable starting point, the end point of the end zone, and the microphone point.

F. Because bystanders have an appreciable influence on meter response when they are in the vicinity of the vehicle or microphone not more than one person other than the observer reading the meter shall be within 50 feet of the vehicle path or instrument, and that person shall be directly behind the observer reading the meter on a line through the microphone and the observer.

G. The ambient sound level (including wind effects) coming from sources other than the vehicle being measured shall be at least 10 dB lower than the level of the tested vehicle.

H. The vehicle path and the area between the microphone and the vehicle path shall be of relatively smooth, dry concrete, or asphalt and free of extraneous material such as gravel, powdery snow, long grass, loose soil, or ashes.

IV. PROCEDURE

A. Vehicle Operation

1) The "Pull Away", or standing start mode of operation, normally produces maximum exterior noise emission and shall be used for the test.

2) Determine the distance from a standing start at which the test bus reaches the maximum noise level for propulsion system equipped models under wide open throttle conditions. It is suggested that an explosive paint marker, or similar system, be used for this purpose.

3) Select the stationary starting point for the test ahead of the microphone such that the maximum noise point will be reached when the chief vehicle noise source (exhaust system, cooling fan,
engine, etc.) * is within the end zone defined in IVD. Under no circumstances shall the starting point be less than 50 feet ahead of the microphone line.

4) The final vehicle speed during the test shall not exceed 35 mph.

5) All auxiliary equipment normally in operation should be turned on during the test. For units with declutching cooling fans, no provision shall be made to alter its normal operation. Tests shall be conducted with the engine cooling fan operating.

6) Wheel slip which affects maximum sound level must be avoided.

7) For vehicles equipped with engine brakes, a deceleration test shall be conducted from maximum to one-half rated governed/or shift speed of the engine. The initiation of the test shall be when the vehicle's front bumper passes the microphone point.

B. Measurements

1) The meter shall be set for "fast" response and A weighted network.

   * Based on overall peak noise levels.

2) The meter shall be observed during the period while the vehicle is accelerating or decelerating. The applicable reading shall be the highest sound level obtained for the run ignoring unrelated peaks due to extraneous ambient noises. Readings shall be taken on both sides of the vehicle.

3) The sound level for each side of the vehicle shall be the average of at least four readings.

VI. GENERAL COMMENTS

A. Measurements shall be made only when wind velocity is below 12 mph.

B. It is required that technically trained personnel select equipment and that tests are conducted only by qualified personnel trained in the current techniques of sound measurement.

C. Proper usage of all test instrumentation is essential to obtain valid measurements. Operating manuals or other literature furnished by the instrument manufacturer should be referred to for both recommended operation of the instrument and precautions to be observed. Specific items to be considered are:

1) The effects of ambient weather conditions on the performance of all instruments. For example: temperature, humidity and barometric pressure.

2) Proper signal levels, terminating impedances, and cable lengths on multi-instrument measurement systems.

3) Proper acoustical calibration procedures to include the influence of extension cables, etc. Field calibration shall be immediately before and after each test sequence. Internal calibration means are acceptable for field use provided that external calibration is accomplished immediately before or after field use.
D. Vehicles used for tests must not be operated in a manner that would cause violation of the break-in procedure specified by the manufacturer.

VII. REFERENCES

A. Suggested reference material is as follows:
   - ANSI S1.1960 Acoustical Terminology
   - ANSI S1.2 1967 Physical Measurement of Sound
   - ANSI S1.4 1961 General Purpose Sound Level Meters
   - IEC Publication 179, Precision Sound Level Meters

B. Application for copies of these documents should be addressed to:

The American National Standards Institute, Inc.
1430 Broadway
New York, New York 10018

NOTE: It should be recognized that variations in sound levels may occur due to variations in test site, temperature differences, test equipment differences, and inherent differences in normally identical vehicles.

TS 11.8 Interior Lighting

TEST STANDARDS FOR PHOTOMETRIC MEASUREMENT OF FLUORESCENT OR INCANDESCENT ILLUMINATION IN SEPTA BUSES

I. SCOPE
   To determine light values, in foot candles, falling upon reading material held by a seated passenger in a transit bus.

II. TEST AREA
   A location where all extraneous light, including exterior lights of the vehicle, can be eliminated so that readings taken within the vehicle shall represent only the direct and indirect light falling upon the recorded positions from sources within the vehicle.

III. TEST PREPARATIONS
   A. Light Source: Fixture reflectors and enclosing prismatic covers shall be cleaned prior to test and fitted with new fluorescent tubes or bulbs whose type and current consumption shall be recorded.
   B. Power Stability: Voltage regulation shall be set to manufacturer's specifications with the engine operating at fast idle during the test.

IV. INSTRUMENTATION
   A. An accurately calibrated light level meter shall be used which is capable of providing filtered readings adjusted to the human visual response for the type of light source being measured.
   B. A support shall be used to position the recording plan of the light cell at an angle of 45° to the horizontal plan and 33 inches above the floor for seated and aisle positions.
C. With the meter in recording position on the support, the vertical centerline of the support's column shall also pass through the center of the area of the light cell. In this position the center of the sensing cell shall be at the 33 inch height specified.

DATA RECORDING

A. Seated Position: The lighting levels at all seating positions shall be tabulated with the column and meter assembly set at the prescribed 33-inch height. The support's center shaft shall be placed in contact with the forward edge of each seat and between the seated recordists knees with the inclined plane of the sensing cell facing him. His attire shall consist of a white shirt, dark colored tie, and a dark suit or sweater. He shall sit erect and record the indicated level in this position.

B. Aisle or Standee Position: Readings shall be taken at eight positions beginning with the centerline of the front stepwell and progressing to the rear in six foot increments. The reading at the vestibule area shall be taken at the 33 inch level with the sensing cell facing the rear of the vehicle at the 45° inclination and on the centerline of the front stepwell. Readings at each of the seven remaining standee positions shall be taken in the following manner:

i To obtain an average reading for each position, the support shaft is placed at each point on the centerline of the aisle taking readings facing forward then toward the rear and recording the average of the back to back readings for each of the seven positions.

C. Stepwell Illumination Levels: In addition, readings shall be taken of the level present at the edges of the stepreads. The meter shall be placed with the sensing cell lying flat in the center of the edge and the level noted by standing at ground level on the outside. The doors shall be held open during the recording of this portion of the test.

NOTE: The recordist shall remain as far away from the meter during the aisle and stepwell portions of the test so as to minimize his influence upon the reading. During readings, all assisting personnel shall remain as far away as is possible for the same reason.

VI. SUMMARY

A scaled drawing of the vehicle shall be made bearing the tabulated levels in foot-candles at each position recorded.

TS 11.9 Anti Skid Strips Location
Minimum 3" wide anti-skid strips shall be installed around the perimeter of the roof unit.

TS 11.10 Paint Requirements
Base Color: PPG DUHS-02839Q White, Imron Elite™ 539319EF, or approved equal.

TS 11.11 Paint Scheme and Decals
Reference TS 11.15
## TS 11.12 Flammability Standards

Federal Register/Vol. 58, No. 201/Wednesday, October 20, 1993/Notices

Table I: RECOMMENDATIONS FOR TESTING THE FLAMMABILITY AND SMOKE EMISSION CHARACTERISTICS OF TRANSIT BUS AND VAN MATERIALS

<table>
<thead>
<tr>
<th>Category</th>
<th>Function of Material</th>
<th>Test Procedure</th>
<th>Performance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seating</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1;2;3;5;9°</td>
<td>Cushion</td>
<td>ASTM D-3675</td>
<td>$1_5 \leq 25$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
</tr>
<tr>
<td>1;5;8</td>
<td>Frame</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
</tr>
<tr>
<td>1;5</td>
<td>Shroud</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
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<td>1;3;4;5</td>
<td>Upholstery</td>
<td>FAR 25.853 Vertical) ASTM E-662</td>
<td>Flame time $\leq 10$ seconds burn length $6$ inches D$_5$(4.0)$\leq 250$ coated; D$_5$(4.0)$\leq 100$ uncoated</td>
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<tr>
<td><strong>Panels</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1;5</td>
<td>Wall</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
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<tr>
<td>1;5</td>
<td>Ceiling</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
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<td>1;5</td>
<td>Partition</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
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<tr>
<td>1;5</td>
<td>Windscreen</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
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<tr>
<td>1;5</td>
<td>HVAC Ducting</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(4.0)$\leq 100$</td>
</tr>
<tr>
<td>5</td>
<td>Light Diffuser</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1/5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
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<td><strong>Flooring</strong></td>
<td>Wheel Well &amp; structural</td>
<td>ASTM E-119</td>
<td>Pass</td>
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<td>6</td>
<td>Carpeting</td>
<td>ASTM E-648</td>
<td>C.R.F. $\leq 0.5$ w/cm$^2$</td>
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<td><strong>Insulation</strong></td>
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<td></td>
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</tr>
<tr>
<td>1;3;5</td>
<td>Thermal</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 25$ D$_5$(4.0)$\leq 100$</td>
</tr>
<tr>
<td>1;3;5</td>
<td>Acoustic</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 25$ D$_5$(4.0)$\leq 100$</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Firewall</td>
<td>ASTM E-119</td>
<td>Pass</td>
</tr>
<tr>
<td>1;5</td>
<td>Ext. Shell</td>
<td>ASTM E-162</td>
<td>$1_5 \leq 35$ D$_5$(1.5)$\leq 100$; D$_5$(4.0)$\leq 200$</td>
</tr>
</tbody>
</table>
### TS 11.13 Time Estimates for Frequently Changes Items and Maintenance Interval Requirements

<table>
<thead>
<tr>
<th>JOB TYPE</th>
<th>Time/Mileage to Maintenance-Mileage/Time</th>
<th>Time Required to replace units/parts</th>
<th>Special Tools and/or Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel Bearing Inspection</td>
<td>To lining replacement/80,000 miles</td>
<td>0.50 hours per location/Front 1.0 per location Rear</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Battery High Voltage</td>
<td>6 years/370,000 miles</td>
<td>16.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>LVDC Battery Pack</td>
<td>7 years/250,000 miles</td>
<td>1.0 hours</td>
<td></td>
</tr>
<tr>
<td>Tire Replacement</td>
<td>N/A</td>
<td>0.50 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Fuel Filters</td>
<td>24,000</td>
<td>0.10 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Air Cleaner</td>
<td>24,000</td>
<td>0.10 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Engine Lube Oil</td>
<td>6,000</td>
<td>0.25 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Propulsion System</td>
<td>12 years</td>
<td>N/A</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Traction Generator</td>
<td>8 years</td>
<td>8.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Traction Motor</td>
<td>8 years</td>
<td>4.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Traction Controller</td>
<td>12 years</td>
<td>2.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>CVT Parallel System</td>
<td>8 years</td>
<td>8.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Final Drive and Gearings</td>
<td>8 years</td>
<td>4.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Catalyzed Soot Filter</td>
<td>100,000/3 year</td>
<td>1.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>All wheel(s) relined</td>
<td>80,000/50,000 miles</td>
<td>12.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Shock Absorber(s)</td>
<td>50,000 miles</td>
<td>0.25 hours per location</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Wheel Alignment</td>
<td>50,000 miles</td>
<td>2.0 hours</td>
<td>Proposer to specify/Contractor shall make property delivery prior to first production bus</td>
</tr>
<tr>
<td>Low Voltage Converter Generator</td>
<td>200,000 miles/5 years</td>
<td>0.75 hours</td>
<td></td>
</tr>
</tbody>
</table>
List any/all special tools required to complete the unit changes listed above.

TS 11.13 Reference § TS 8.4.1-Quick Coupler Part # - ¼" Air Industrial.

TS 11.14 Reference § TS 9.3.10-Exterior Paint Scheme, PPG DUHS-92839Q Imron Elite 539319EF™ or approved equal.


TS 11.16 Reference § TS 9.3.12-Non FMVSS-108 lighting, Side Turn Signals and Collision Avoidance Brake Light, Kneeler and Wheel Chair Ramp - Dialight.


TS 11.19 Reference § TS 9.4.4.5-White Melamine - Formica Corp. #949.

TS 11.20 Reference § TS 9.4.4.7-Globe Dual Transfer Cutter Part# 304.

TS 11.21 Reference § TS 9.5.1.4-Passenger Seat Material, LaFrance#ECO362-047E-07-8886-976 Holsworth Part# A 816 SG

Reference § TS 9.4.3 - Rear Bulkhead Covering, LaFrance#ECO362-047E-07-8886-976, Holsworth Part# A 816 SG

Reference § TS 9.5.4.5, Wheel Chair Seat Material, LaFrance#ECO362-047E-07-8228-976

TS 11.22 Reference § TS 9.6.6.2-Mirrors, interior:

a) Rear View Mirror-Rectangular convex H 8" W 16"
b) Relay Mirror - Round flat  Diameter 8"

c) Entrance Door - Rectangular convex  H 5"  W 10"

d) Rear Door Mirror - Round convex  Diameter 11.5"

e) Bicycle Rack Mirror - Round Flat  Diameter 6"


TS 11.25 Reference § TS 9.3.12-Help Light Part # Preco #3414ADLPC.

TS 11.26 Reference § TS 9.2.6.3-fare Box Cable and Quick Release hardware, Appendix 5
    Cables-Appendix #5
    Quick Release Hardware- Hardware Kit "A" (pt # 700-5504): HECS Inc

TS 11.27 Reference § TS 9.9.4, Handset/cradle/Speaker-Part# Audiosears Corp., part number, 1039A00BRBJDUC-QDX43

TS 11.28 Contractor Required Testing, Certification and Documentation

<table>
<thead>
<tr>
<th>Specification Section</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS 7.1.4</td>
<td>Acceleration &amp; Top Speed</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 7.1.3</td>
<td>Gradability</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 5.21.3</td>
<td>Electronic noise control</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 5.21.2</td>
<td>Exterior noise-Ref. Attachment</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 5.21.1</td>
<td>Interior noise-Ref. Attachment</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 5.22</td>
<td>Engine emissions (# 2 fuel) ULSD</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 5.14</td>
<td>Applied coatings to frame</td>
<td>Provide Certification</td>
</tr>
<tr>
<td>TS 7.7.4.1</td>
<td>Intermediate and Final Drive Balance Requirement</td>
<td>Provide Manufacturer Certification</td>
</tr>
<tr>
<td>TS 9.2.1.2</td>
<td>Strength and fatigue life</td>
<td>Provide documentation of STURRA Testing</td>
</tr>
<tr>
<td>TS 9.2.1.2</td>
<td>Distortion (body alignment)</td>
<td>Provide documentation of STURRA Testing</td>
</tr>
<tr>
<td>TS 9.1.4</td>
<td>Corrosion (salt spray test)</td>
<td>Provide test certification &amp; documentation</td>
</tr>
<tr>
<td>TS 5.13</td>
<td>Welding (welder certification)</td>
<td>Provide certification</td>
</tr>
<tr>
<td>TS 9.1.2</td>
<td>Crash worthiness</td>
<td>Provide test certification</td>
</tr>
<tr>
<td>TS 9.2.5.2</td>
<td>Floor strength (deformation)</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.2.7.2</td>
<td>Wheel house</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.2.7.1</td>
<td>Brake Overheating</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 9.4.6</td>
<td>Interior lighting</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 5.15</td>
<td>Operators area Barrier/lighting</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.5.1.3</td>
<td>Passenger seating Structure/Design</td>
<td>Provide Documentation</td>
</tr>
<tr>
<td>TS 9.6.5.2</td>
<td>Operators seat/Structure</td>
<td>Provide certification</td>
</tr>
<tr>
<td>TS 9.4.4.7</td>
<td>Insulation – Material and Properties</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 7.7.1</td>
<td>Cooling system (radiator blockage test)</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 7.6.1</td>
<td>Engine Application Testing</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 7.7.2</td>
<td>Power Plant Mounting</td>
<td>Provide Documentation</td>
</tr>
<tr>
<td>TS 7.7.1.1</td>
<td>Radiator</td>
<td>Provide core sample</td>
</tr>
<tr>
<td>TS 5.6</td>
<td>Propulsion system Application</td>
<td>Performance Test/Documentation</td>
</tr>
<tr>
<td>TS 8.3.1</td>
<td>Brakes (general) brake test</td>
<td>Performance test-Tapley test to be performed on each production bus.</td>
</tr>
<tr>
<td>TS 8.3.1.3</td>
<td>Brake lining gauge</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 8.4.2</td>
<td>Air compressor (performance data)</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.3.9.5</td>
<td>Impact protection (certification)</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.7.4.2</td>
<td>Material/Glazing</td>
<td>Demonstration @ Pilot</td>
</tr>
<tr>
<td>TS 10.7</td>
<td>Battery performance</td>
<td>Test certification</td>
</tr>
<tr>
<td>TS 10.3.1</td>
<td>Wiring Termination</td>
<td>Provide bill of materials</td>
</tr>
<tr>
<td>TS 10.6.4.1c</td>
<td>Power Supply Conditioning</td>
<td>Performance Test</td>
</tr>
<tr>
<td>TS 10.6.4.1</td>
<td>Interface &amp; compatibility</td>
<td>Provide test documentation</td>
</tr>
<tr>
<td>TS 10.6.4.1</td>
<td>Power control management – input/output</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 10.6.4.1 d</td>
<td>TDR Ballistic Test</td>
<td>Contractor shall test all data networks to verify J1939/11-15 and other applicable physical layer implementation. Contractor shall provide an independent 3rd party laboratory report.</td>
</tr>
<tr>
<td>TS 10.1.2</td>
<td>Software License and Program</td>
<td>Provide documentation &amp; software including file &amp; file password</td>
</tr>
<tr>
<td>TS 10.1.3</td>
<td>Multiplex Integration</td>
<td>Provide Documentation</td>
</tr>
<tr>
<td>TS 10.1.1.4</td>
<td>Generator output curve</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.8.3.2</td>
<td>Defroster Test/Operators area climate control</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 9.8.4.2</td>
<td>Air filter capacity</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.8.1.3</td>
<td>Door operation cycle</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 9.8.1.5</td>
<td>Production checks</td>
<td>Provide documentation</td>
</tr>
<tr>
<td>TS 9.8.1.6-10</td>
<td>HVAC Performance Test</td>
<td>Performance Test</td>
</tr>
<tr>
<td>TS 9.8.3.2</td>
<td>Driver’s Heater/Defroster Noise Test</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 9.8.6.1</td>
<td>HVAC Motor Application</td>
<td>Provide Documentation/Specimen</td>
</tr>
<tr>
<td>TS 9.8.9.3</td>
<td>Thermal performance</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 9.9.7.4</td>
<td>Performance test (ASAS, CARD-AVL, AVM system)</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 10.6.4.1d-vi</td>
<td>Network Test</td>
<td>Septa approved 3rd party test</td>
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<tr>
<td>TS 10.9</td>
<td>Fire extinguishers &amp; detectors</td>
<td>Endorsement documentation</td>
</tr>
<tr>
<td>TS 9.7.4.2</td>
<td>Water test</td>
<td>Performance test</td>
</tr>
<tr>
<td>TS 9.9.7.16</td>
<td>IVS Commissioning</td>
<td>Pre-qualifying document submittal(s) BOM&amp; test plan/Contractor tendered</td>
</tr>
</tbody>
</table>
TS 11.29 Reference § TS 9.9.6.1

Vehicle Based Video Data Equipment 40’ Bus Application

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MDR5L</td>
<td>DTI, 2 Terabyte of Storage Space</td>
</tr>
<tr>
<td>9*</td>
<td>As specified by DTI</td>
<td>Color-460 TVL – Lens = 2.9mm, Surface</td>
</tr>
<tr>
<td>1</td>
<td>As specified by DTI</td>
<td>Front Facing Camera–3.8mm to 8mm Auto Iris lens W/Housing</td>
</tr>
<tr>
<td>1</td>
<td>As specified by DTI</td>
<td>Panic Button/Status Light, Red and Green, installation kit</td>
</tr>
<tr>
<td>1</td>
<td>As specified by DTI</td>
<td>Mobile Wireless Router Wi-Fi, Wi-Max</td>
</tr>
<tr>
<td>1</td>
<td>As specified by DTI</td>
<td>Mobile Antenna, Wi-Fi, Wi-Max</td>
</tr>
<tr>
<td>1</td>
<td>As specified by DTI</td>
<td>3 Axis Accelerometer</td>
</tr>
</tbody>
</table>

*-Spare cameras to be determined at Pilot Inspection Phase

TS 12. Training and Documents

TS 12.1 Training and Documents
The Contractor shall provide an in-service Maintenance and Drivers educational school on SEPTA’s premises. Maintenance Training shall be scheduled for a period of not less than 150, eight-hour days. The curriculum for the schools shall incorporate all methods of safely and properly maintaining and operating the delivered buses. Driver training shall be scheduled for a period of not less than 24 hours of training solely for the purpose of training the driving instructors. The Contractor shall respond to SEPTA’s assessment with appropriate modifications to the training program when deemed necessary.

TS 12.1.1 General
The Contractor shall prepare and provide an educational program for the following SEPTA departments of operation.

Engineering Staff

Maintenance Managers Training Program. (2 day supervisory overview).

Driving Instructors Program.

SEPTA Technical Instructors. (2 week train the trainer program).

Maintenance Mechanics Training Program. (see table TS 12.1.4.2.).

These training modules shall be of a quality and depth sufficient enough to safely and properly operate, maintain and repair delivered vehicles. These programs shall include formal and informal instruction, mock-ups, models, manuals, diagrams and parts catalogs. The Contractor shall assume no knowledge of the features of the buses on the part of SEPTA’s personnel and shall design the programs to bring the level of knowledge to one which is fully adequate for the objective. The Contractor may assume that SEPTA’s personnel have the basic skills pertinent to their crafts. The Contractor’s approach to this effort shall be based on the assumption that his own interests, immediate and ultimate, are best served by a satisfactory program. All courses of instruction and manuals shall be presented in the English language.

Sixty days (60) before the scheduled delivery of the first production bus the Contractor shall submit to SEPTA for approval, an outline of the educational programs and a schedule for its presentation. The programs shall be conducted at SEPTA’s facilities at hours that are mutually agreed upon by the Contractor and SEPTA. There shall be an adequate supply of high quality, professionally prepared material on paper, as well as video tapes and other such training aids as may be necessary to impart essential knowledge to the personnel involved and leave them with the authoritative and up-to-date reference material. The educational programs shall be designed to include steps to determine the proficiency of all the students. SEPTA will approve the outline and schedule within thirty days or require such changes, as it may deem desirable within the intent of this Specification.

The Contractor shall also submit to SEPTA, for approval, Tables of Content and sample formats for all the manuals and the Parts Catalog. Delivery of final drafts of manuals, catalogs and prints for each student shall occur sixty (60) days prior to initiation of classroom instruction for the student classification, (i.e. maintenance and parts catalogs prior to the first Maintenance Instructor’s and Maintenance Supervisor’s class).

**TS 12.1.2 Objectives**

The primary objective of the educational programs will be to:

Train SEPTA’s Engineering Staff. Engineering training shall consist of targeted training designed to train the engineering staff for specific subjects for their specified duties and responsibilities.

Course scheduling shall be coordinated through the office of the Manager of Automotive Engineering or his elects. The Contract shall submit course descriptions to the Manager of Automotive Engineering or his elects as specified by § TS 12 overall.

Train the Driver Instructors to the extent that they will be proficient in the instruction of other instructors or operators that were unable to participate in the manufacture’s course(s). Include text from handout (see attachment).
To train the Maintenance Managers to the extent that they are fully aware and knowledgeable of the systems and subsystems installed on the vehicles. A diagnostic emphasis shall be placed on the curriculum developed and disseminated among the Maintenance Managers. Maintenance Managers shall receive all subsystem diagnostic reference material and troubleshooting guides. Maintenance Managers shall be trained to the extent where their knowledge can be shared and distributed with their subordinates.

To train SEPTA’s Technical Instructors to the extent that they fully understand not only the operation, maintenance, and troubleshooting of the vehicle and its subsystems, but also are fully cognizant on how to teach the maintenance mechanic courses. Technical Instructors should be fully familiar with course outlines, lesson plans, quizzes, tests manuals, training aids or other mock-ups necessary for use in successful completion of the course.

To train SEPTA’s maintenance personnel to the extent that they fully understand and can perform any and all maintenance procedures or repairs for the class venue that they are attending. Maintenance personnel shall receive a full complement of technical reference material or troubleshooting guides to use or refer to when performing such tasks.

**TS 12.1.3 Training Plan**

Two to four weeks prior to the delivery of the first scheduled production bus, the Contractor shall provide at the Contractor's expense a two-week training session at and for SEPTA’s Technical Instructors. This two-week course shall be a technical overview of the complete vehicle and its subsystems. Technical Instructors will not only learn the operation and maintenance of the vehicle but also the materials, mock ups and lesson plans used to teach the course. This course shall be conducted at SEPTA during mutually agreed upon hours between the Contractor and SEPTA. SEPTA’s instructors reserve the right to amend or make changes to the material or outlines prior to SEPTA’s maintenance mechanics training courses. This program shall provide for formal classroom instructions, and a period of time to perform maintenance function in on-bus and shop environments. SEPTA’s Training Instructors shall be exposed to the depth of detail that is orientated to the performance of preventive (scheduled) and corrective (unscheduled) maintenance operations.

Upon delivery of the first scheduled production bus, the Maintenance Manager and or the Maintenance Mechanic training modules shall commence. Courses shall be scheduled in a manner, which complements the delivery and maintenance issues of the new vehicle. Maintenance Manager training modules shall be conducted in accordance with the objectives in Section TS 12.1.2 (paragraph 3) Maintenance Mechanics Training shall be conducted in full compliance with the objectives in Section TS 12.1.2. (paragraph 5)

Upon delivery of the first production bus and during the Pilot Bus Demonstration, Driver Instructor training shall be conducted in accordance with the objectives in Section TS 12.1.2 (paragraph 2). The Driver Instructor training will be coordinated by Operations Training.

**TS 12.1.4 Course Scheduling and Disciplines**

All courses, except Automotive Engineering requirements, shall be completed by a mutually agreed to time by the Authority's training/safety departments and the Contractor's training departments.

**TS 12.1.4.1 Course Scheduling**

SEPTA’s courses shall have a length commensurate with material required for in-depth presentation. Classes shall be scheduled on a forty (40) hour workweek basis, eight (8) hours per day, five (5) workdays per week. SEPTA’s holidays shall be observed. Breaks during class will be at the instructor’s discretion but will be no less than one before and one after lunch. Length of practical application periods is not fixed.
Maintenance courses shall be scheduled and consist of the subject matter as seen in the table in Section TS 12.1.4.2.

Courses will be scheduled in a manner that complements our experience and maintenance requirements of and for the new vehicles.

**TS 12.1.4.2 Course Disciplines**
The following is a recommended list identifying course disciplines. Class topics are not limited to those listed. Four classes or total hours are indicated for each subsystem taught.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Engineering/Training Dept. Training Requirement</th>
<th>ENG. Hours / Modul es</th>
<th>General Training Modules/ Hours</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axles/ Brakes/ Air Systems/ ABS/ ATC</td>
<td>Software instruction</td>
<td>8/1</td>
<td>16 per class or</td>
<td>24</td>
</tr>
<tr>
<td>Chassis/ Suspension/ Frame/ Alignment/ Steering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC- Operation/ Maintenance/ Troubleshooting</td>
<td>Software instruction, detailed circuit analysis</td>
<td>8/1</td>
<td>24 per class or</td>
<td>96</td>
</tr>
<tr>
<td>Destination Sign/ ASAS/ AVM/ VTU</td>
<td>Software instruction, detailed circuit analysis</td>
<td>8/1</td>
<td>16 per class or</td>
<td>64</td>
</tr>
<tr>
<td>Engine- Operation/ Maintenance/ Troubleshooting</td>
<td></td>
<td>8/1</td>
<td>16 per class or</td>
<td>64</td>
</tr>
<tr>
<td>Engine Overhaul (at close of warranty)</td>
<td></td>
<td></td>
<td></td>
<td>128</td>
</tr>
<tr>
<td>Propulsion system-Operation/ Maintenance/ Troubleshooting</td>
<td>Software instruction, detailed circuit analysis, drive topology</td>
<td>16/2</td>
<td>8 per class or</td>
<td>32</td>
</tr>
<tr>
<td>Propulsion system Overhaul (at close of warranty)</td>
<td></td>
<td></td>
<td></td>
<td>128</td>
</tr>
<tr>
<td>Emission System Operation and Filter Maintenance Training</td>
<td>2/16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module 1-Removal of unit from vehicle Module 2-Cleaning Methodology Module 3-Overhaul</td>
<td></td>
<td>8 per class or</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Module 2-Cleaning Methodology Module 3-Overhaul</td>
<td></td>
<td>8 per class or</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Module 3-Overhaul</td>
<td></td>
<td>16 per class</td>
<td></td>
<td>48</td>
</tr>
<tr>
<td>Hydraulics (cooling system/ steering, etc..)</td>
<td></td>
<td></td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Towing/ Recovery/ Emergency Procedures</td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Wheelchair Lift/Ramp Operation/Maintenance/ Troubleshooting</td>
<td></td>
<td>8 per class or</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>
### Wheelchair Lift Overhaul

| Training | Specific modules, communication methods over system architecture. | 8/2 | 24 per class or | 96 |

#### Electrical Basics / Multiplex

- **Wheelchair Lift Overhaul**: 24 per class or 96
- **Electrical Basics / Multiplex**: Training to include full CAN analysis and CAN audit conducted at training session.
- **Multiplex Programming**: Overall familiarization specific programming instruction-Include cert-conference.
- **Electrical Unit(s) Overhaul**: 8 per class or 32
- **General Familiarization**: 8/3 8 per class or 64
- **Differential Overhaul (at close of warranty)**: 8 per class or 32
- **Preventive Maintenance Inspection**: 8 per class or 32
- **Fire Suppression System**: 4 per class or 16
- **Auxiliary Heater**: 4 per class or 16
- **Door Control System**: 4 per class 32
- **Auxiliary Systems Training**: Familiarization, Systems integration, systems diagnostics and repair for DC/DC Converters DC/Medium Voltage Inverters and related systems, Includes Safety Training.
- **Maintenance Manager Training**: 8/1 16 per class or 64
- **Application Software Training**: 48/6 96

**TOTAL HOURS**: 192 1,632

Additional Equipment not included in above total: 16 per class or 64 total

### TS 12.1.5 Operations Training

The Contractor shall provide complete training and instruction for designated Bus Operator Instructors, Street Supervisors and Dispatchers. The program shall include but not be limited to, the following:

1. Operator Compartment
   a) Controls and Switches
   b) Warning Indicators and Gauges
   c) Seat Adjustment
   d) Door Control
2. Walk Around Inspection
   a) Compartment-by-Compartment Explanation
   b) Mirror Adjustments
   c) Climate Control System
   d) Fuel System

3. Driving Instruction
   a) Turns
   b) Braking
   c) Propulsion system
   d) Backing

4. Mobility Aid / Ramp Systems
   a) Controls
   b) Safety
   c) Emergency Procedures
   d) Securing Mobility Aids and Riders
   e) Loading and Unloading

The Operations Training Program shall consist of a 3 each, 8-hour modules, with 5 trainees in each module, on
the Bus. Each Trainee will be given an opportunity to operate the bus with the Contractor's instructor on board.
The Contractor shall provide the Operation Training Program twice. The Operator's Manual will be used as a
training aid.

**TS 12.1.6 Training Aids**

Training aids shall be present at the commencement of Technical Instructor training module. (Two to Four weeks
before the scheduled delivery of the first production bus.)

Training aids for both the Operator and the Maintenance Classes shall consist of:

1. Operation and Maintenance Manuals. The Contractor shall submit the complete proposal of training aids in
   conjunction with Vendor's Equipment Specification (Attachment #1) for SEPTA's evaluation and approval.

2. Technical Training programs shall be presented and submitted as Contract training aids in both Microsoft
   Power Point presentations and in hard copy. These programs shall illustrate sub-assemblies showing
   component locations, component cutaways, schematics, and wiring diagrams. Diagrams depicting hydraulic,
   pneumatic and air conditioning systems shall include direction of flow for the particular medium.

3. Proper nomenclature for all components shall be applied and shall be in accordance with the terminology used
   on schematics and wiring diagrams incorporated in operating and maintenance manuals.

4. Illustrations, drawings, diagrams, charts or tables to be used by an instructor during a course shall be prepared
   in the form of a visual display that can be readily seen by a student at a minimum distance in an ambient light
   condition that permits student reference to a similar but smaller illustration. Generally, these restrictions
   imply that such training aids be video tapes, transparencies or view graphs projectable by appropriate
   equipment, or large charts or posters prepared for wall or easel mounting.
5. The content and format of audio-visual aids utilized in the training courses or provided with the training equipment shall be approved by SEPTA.

6. The Contractor shall make corrections and improvements to all training aids during the conduct of the course when examinations, tests, or instructor observations indicate that a majority of students fail to attain the learning objectives.

7. Suitable protective covers shall be provided for each audio-visual aid master reproducible.

8. Test points shall be incorporated on all simulated panels together with all hardware necessary for maintenance operations.

9. Proper nomenclature for all components shall be applied, and shall be in accordance with the terminology used in schematics and wiring diagrams incorporated in operating and maintenance manuals.

10. All training materials, to include schematics, diagrams, mock-ups, cutaways, and lesson plans shall become property of SEPTA at the completion of the training programs. The Contractor shall be responsible for the condition of these materials for the duration of the training program, and shall replace all damaged materials unless the damage resulted from neglect by SEPTA. All training materials shall be updated as required during the course of instruction. Document sets used in training shall be supplied in authoring file form and PDF format as required in Section TS 12.2.

**TS 12.6.1.1 Physical Training Fixtures**

The Contractor shall furnish a number of interactive fixtures designed for classroom demonstration. All fixtures shall be safe for use a classroom instruction by trained personnel whereby said equipment is properly operated for its intended purpose. All equipment furnished shall be fully documented permitting the user to repair the core and ancillary equipment as required.

The fixture(s) shall operate from 120Vac current, all equipment and power supplies shall be galvanically isolated.

Where microprocessors are utilized, they shall be fully documented and supported from standard PC based platforms and operating systems.

The demonstration fixture shall functionally represent the door system delivered under this contract including all option equipment and necessary chassis multiplex system integration.

All fixtures and demonstration equipment shall be arranged with lockable casters or like equipment in order to facilitate movement in the classroom area.

1. Rear/center door fixture

   **Operational Goal:** Full operation of door system demonstrating operation with deliberate fault assignments.
   
   **Physical Form:** The Contractor of equipment shall ensure the fixture can be arranged for delivery to an office type environment by means of customary portal structures.
   
   **Customer Specific function list**
   
   The door training module shall have the following salient features:
   
   k.) Direct control of all door operating functions from a remote pendant control panel.
   
   l.) Selectable function drift/cutout and disablement of control and switch points with indication.
m.) Full access to view functional and operating components, permit full range adjustments and equipment removal/reinstallation.

n.) Integrated air compressor and air supply tank.

o.) Out-rigging, or ballasting arrangement permitting stable and safe operating of the demonstration unit.

p.) Integrated retractable mains cable.

q.) Master remote and integrated emergency stop feature, with rapid air dump.

2. Vehicle Multiplex System
   The Contractor shall furnish a vehicle multiplex training model board(s) that is an exact function representation of the delivered bus system including all real and virtual signal sources and conditions.

   Operational Goal: Full emulation, functionality and simulation of operating vehicle multiplex system.

   Physical Form: The supplier of equipment shall ensure the fixture can be arranged for delivery to an office type environment by means of customary portal structures.

   Salient features as follows:
   a.) Integrated retractable mains cable.
   b.) Fully isolated mains power supply.
   c.) Function switch and input state control with indication.
   d.) Integrated input/output circuit breakout taps.
   e.) Accurate geographical system layout representation.
   f.) CAN message generator-a stand-alone or PC based CAN emulation generator that furnishes all system telegrams required to accurately and faithfully represent the as built multiplex and peripheral system(s) originating and throughput functions.
   g.) Reserved

3. Pneumatics Training Module
   The contractor shall furnish a vehicle pneumatics, brake system and suspension model board(s) that is an exact function representation of the delivered bus system including all real and virtual signal sources and conditions, necessary shop air inputs and all other components required to make the training device a full functional representation of the system as built.

   Operational Goal: Full emulation, functionality and simulation of operating vehicle pneumatic, braking and suspension system.

   Physical Form: The supplier of equipment shall ensure the fixture can be arranged for delivery to an office type environment by means of customary portal structures.

   Salient features as follows:
   a.) All components shall be represented. Compressor shall be physically revealed (internal components shown) and its constituent parts shall be removable for demonstration but not operational.
   b.) The air dryer and ancillary equipment shall be physically revealed (internal components shown) and its constituent parts shall be removable for demonstration but not operational.
   c.) Pneumatic valves required for operation shall be equipped with isolated gauge(s).
   d.) If an articulating bus is purchased coincidently to a non-articulating bus-the corresponding axle, braking components, suspension, supply tanks, and all other necessary equipment shall be arranged for the converting of the pneumatics training module to both vehicle types (60’ and 40’) by deletion of one module from the multi-modular board.
   e.) The brake actuators shall be models representing actual functionality for demonstration and adjustment purposes.
f.) The ABS/ATC systems shall operate and demonstrate actual programmed differential velocity via programmed frequency generation.

4. AVL/M Training Module

**TS 12.1.7 Classroom Instruction**
Classroom instruction shall inspire the respect of the students. Instructors shall have qualified themselves fully for their presentation. Qualifications will be considered to be adequate - (1) When the designer of the system is the instructor and has the desire and ability to communicate the facts about the system to others in understandable terms; or (2) When the instructors have been trained in teaching methods and have familiarized themselves fully with the subject matter. In all cases, lesson plans shall be prepared and submitted to the Contracting Officer at least thirty days prior to the class. These lesson plans shall include an outline of the material to be presented and copies of the training aids to be used.

Training aids shall include actual samples of manually operable devices and working samples of devices, the functions of which can be displayed without dismantling the device, e.g., door operating controller. The workings of other significant components shall be illustrated with diagrams, cutaway view, etc., displayed with sufficient scale and clarity to permit all to see clearly.

Wiring diagrams, when used as training aids and reference material, shall be divided to facilitate comprehension. There shall be single-line functional diagrams of systems and schematic diagrams of each component in the systems. Where parts are identified by initials or reference numbers, there shall be a key to permit precise identification.

Classroom instruction shall include not only the anatomy and functioning of the parts under discussion but the essentials of their routine care including lubrication schedules, materials, Contractor's recommendations for test frequency, tolerance limits and methods for testing, including instruments required, when applicable. When methods of access, removal, dismantling, or application are not self-evident to a reasonably intelligent individual, the instruction shall cover these matters. Overhaul procedures are to be taught in separate classes.

The classroom instruction for maintenance personnel shall be conducted at sites designated by SEPTA and shall be of suitable character, with classes normally not exceeding fifteen (15) students and not exceeding eight (8) hours per normal working day. The location and class times, however, shall be at the convenience of SEPTA. SEPTA will supply a reasonable amount of assistance in the movement of equipment, apparatus, etc., within its own property and it will furnish suitable furniture (desks, tables, lecterns, etc.). When instruction in subsequent courses is conducted after the arrival of the buses on SEPTA's property, the latter will, if requested, facilitate visits to a bus if desirable for the instruction.

The Contractor shall supervise all classes. Audio-visual methods of instruction (movies, with synchronized sound, etc.) are required but there shall be a competent Contractor's or Supplier's representative (instructor, engineer, technical representative) present to answer questions on material presented.

At the conclusion of the classroom instruction the Contractor shall furnish to SEPTA a complete set of lesson plans in hard copy and electronic form and all other material used in presenting the course, including film, transparencies, view graphs, tapes, other apparatus and exit tests unique to each lesson plan.
**TS 12.1.8 Field Instruction**
The extent of instruction in the contractor's and subcontractor's shops shall be at the discretion of SEPTA. SEPTA may request access to these shops for limited numbers of supervisory and technical personnel to familiarize them with assembly methods; and the Contractor shall make a reasonable effort to comply with such a request, but not to detriment of production. Similarly, SEPTA's operating supervision shall be granted access to all equipment for the purpose of familiarization.

Field instruction involving use of a bus shall be presented by instructors having thorough experience in maintenance services or operation, as the case may require. They shall have their subjects properly organized prior to commencement of the class. Instruction in operation shall follow a logical progression involving the anatomy of the bus, the manipulation of all control, and actual operation.

SEPTA will make available, upon proper notice, an advance design bus at accessible shop locations for instructional purposes; and will arrange for road operation as well as furnishing power, dispatching, and operational supervision as necessary. There will be no charge for the cooperation.

**TS 12.2 Documents**
The Contractor shall furnish forty (40) complete parts books. The Contractor shall furnish one hundred (100) maintenance manuals and 10 indexed sets of reproducible drawings showing wiring schematics of all electrical circuits which shall include pneumatic, air line diagram, all Contractor's drawings necessary for the maintenance, heavy repairs and comprehensive body restoration of the buses. Two thousand (2,000) operator's manuals, twenty (20) draft parts manuals, twenty (20) draft maintenance manuals along with forty (40) electronic versions (authoring and PDF) of the manuals on CD ROM will be sent with the first bus. These quantities shall be equally divided among the production orders.

Original authoring electronic format files shall be adjusted for pagination to mirror published versions using Acrobat Distiller settings so when a PDF file is created, the end result will be a matched copy. Each file shall contain one section of the manual. Bookmarks shall be included based on the subsections found within the file and linked to the associated information. All PDF files shall remain unlocked. File sizes must be kept to a minimum. To control file sizes, distillation settings for the Acrobat Distiller should be set to 300 DPI to produce files that are both optimized for SEPTA web/intranet use and still retain the ability for clear printing from a desktop printer. All text within PDF files shall be searchable and capable of indexing within the Adobe programming environment.

Authoring files for parts data shall be spreadsheet based. All fields shall be text formatted with exception of fields that may require mathematical calculation. An additional field for the inclusion of SEPTA lot and class numbers (10 characters minimum) shall be included in both the spreadsheet and manual versions.

It is the Contractor's responsibility to secure and make whatever agreements are required to transfer component text and drawings to electronic media. When electronic media is delivered as part of this Contract, the Contractor shall supply the information with a site license agreement with no limitation(s) for reproduction or use by SEPTA within usual business practices.

The Contractor shall furnish all completed and finalized manuals coincident to delivery of the first production bus of every series governed by this specification. A set of Draft Operator's and Maintenance Manuals shall be delivered with Pilot Vehicle(s).
All drawings, publication, catalogs and manuals including Training Materials required under this Specification shall be furnished in electronic form in addition to the form specified elsewhere in this Specification. Electronic versions of these documents shall be furnished concurrent with their submittal in hard copy form. The drawings shall be furnished in an electronic format compatible with the latest version of AutoCAD. Catalogs, publications manuals, lesson plans and training materials shall be furnished in the Adobe Acrobat electronic format.

Thirty complete sets of engine and propulsion system maintenance, troubleshooting and overhaul manuals, as published by the respective component OEMs shall be provided. These quantities shall be for each of the production orders.

**TS 12.2.1 Format**

They shall be complete, modern, thoroughly organized, and authentic with no extraneous material such as advertisements of irrelevant information. The publications shall be designed for continuous, long-term service except for the loose-leaf feature required below. Draft copies or gallery proofs shall be submitted to the Project Manager for approval not less than thirty (30) days before the deadline for final printing.

The bus shall be treated as a whole and not as a grouping of disassociated parts. The material in the Maintenance Manuals and the Parts Catalogs shall be similarly organized and indexed, with a standard numbering system in accordance with an approved Contractor's outline. Indexing of the pocket-size manuals may be abbreviated as required to achieve compactness.

The format of all data contained in each section of the maintenance and parts manual shall be consistent from section to section.

**TS 12.2.2 Configuration**

Pocket size manuals shall be 4-1/4 inches wide, 7 inches high, and not more than 1-1/4 inch thick. They shall be bound along the 4-1/4 inch dimensions and the pages therein shall be as large as can be accommodated without damage. Manuals should be of 8-1/2 x 11 inches to 12 inches high. The 8-1/2 x 11 inch should be heavy-duty binders and shall not exceed 4 inches maximum overall thickness. Punch holes for all manuals shall have 1/2 to 5/8 inch centers. Folding pages will be permitted where the information to be conveyed cannot be presented clearly on single pages. Manuals for 8-1/2 x 11 inch pages may be divided into Book 1, Book 2, etc., if the materials cannot be obtained with the maximum binder thickness. Adequate cross-reference and Table of Contents shall be provided in each book.

All covers shall be approximately 1/16 inch thick, resistant to oil, moisture, and wear, to a high degree commensurate with their intended uses. Diagrams and illustrations shall not be loose or in pockets. All printed material shall be clearly reproducible by dry copying machines and this precludes the use of halftone illustrations. Line drawings are required.

**TS 12.2.3 Content**

All sections shall be subdivided, to the extent required by the subject matter, into the following topics:

- General subsystems description and operation.
- Block diagram.
- Functional schematics.
- Functional wiring and/or piping diagrams.
- Troubleshooting techniques.
• Lubricating and cleaning, including frequency, methods and trade identifications of recommended materials; component location and description.
• Inspection and maintenance standards including wear limits, settings, and tolerances.
• Installation and removal.
• Test and evaluation procedures.

NOTE: The detailed contents of sealed assemblies need not be displayed but their function shall be explained and the appropriate voltage and current values shown for each external terminal. Procedures appropriate to their replacement, including methods and tests, shall be stated.

The manual shall be logically organized with systems and elements considered in descending order of importance. Care shall be taken that all statements are clear, positive and accurate, with no possibility of incorrect implications or inferences.

The Maintenance Manual shall contain a detailed analysis of each component of the bus so that maintainers can effectively service, inspect, maintain, adjust, troubleshoot, repair, replace and overhaul it. It shall also include all information needed for periodic inspection and servicing requirements, including lubrication, inspection and adjustment of all apparatus in a separate section of the manual.

The Maintenance Manual shall enable the maintainer to have with him, in convenient form, all information needed for on-bus running maintenance and adjustment, and on-line trouble diagnosis of each system, including such data as troubleshooting guides and schematics for the bus and each of its systems.

The Parts Catalog shall enumerate and describe every item used on the buses, along with special equipment(s) with its related parts, with each listing including the accepted generic modified noun name description, the original supplier, its part number and name, the Contractor's part number if used, all commercial equivalents and provision for entry of SEPTA's fifteen (15) digit class and lot number. Each component that can be disassembled must be broken down in illustrations to its indexed parts, and shall be formatted as follows:

| Page number-illustration reference/illustration | Description of part-English-noun/description-salient features, pertinent characteristics, (e.g., hose, pressure rating OAL fitting type and number)/application | Contractor's Part number | OEM Part number, most generic-not assigned by Contract/OEM name, address phone, fax and email/commercial equivalents (CE),(1) min.* | Column reserved for SEPTA inventory enumeration |

• Note-Contractor to supply complete drawing and material list of quality sufficient to enable SEPTA to Contract manufacturing.
• No Production bus(s) may be accepted prior to SEPTA’s approval of material and parts list as specified herein.

Prior to publication, SEPTA’s representative shall be afforded the opportunity to identify parts with SEPTA's class and lot number for inclusion in this parts catalog by the Contractor. SEPTA shall have the right to make direct purchase from the sources listed by the Contractor.
The Contractor is required to provide an Altered or Modified Part Drawing for items that have been reworked by the Contractor if the bus is unable to operate in revenue service and the Contractor is unable to provide a replacement within three working days after placement of our order during the warranty period; seven days for all other parts requests. This drawing shall list the manufacturer's part number and describe how the item has been modified. The Contractor shall supply SEPTA with all drawings necessary to reproduce items modified by the Contractor. The drawings and specifications shall be the property of SEPTA.

Cutaway and exploded drawings shall be used to permit identification of all parts. Parts common to different components (as, for example, bolts and nuts) shall bear the same Contractor's number with a reference to the other components in which they are found. Each part of other components shall be identified as being part of the next larger assembly.

Operation and Maintenance manuals for the test devices shall include, and be presented in, the format required of this section.

Following the issue of each publication, the Contractor shall provide revised pages covering any changes, whether required by change of design or procedures or due to error, and these revisions shall be kept current during the warranty period. Manual and catalog revisions shall be supplied to SEPTA before or coincident to the arrival of the altered parts of components. After the warranty period, revisions shall be supplied to SEPTA on an as required basis per section GC 9.3 Parts Availability Guarantee.

**TS 12.2.4 Spare Parts List**
A suggested parts list required for normal maintenance of the fleet of vehicles to be purchased shall be furnished by the Contractor with the net price shown for each item. The Contractor shall furnish current price information. This parts list shall be delivered at least 60 days prior to the delivery of the first production bus in electronic spreadsheet form. An additional field sized for the inclusion of SEPTA lot and class numbers (10 characters minimum) shall be included. All fields shall be in text format with exception of fields that may require mathematical calculation. Suggested Parts List shall be provided periodically as new information becomes available for the duration of the production run(s). A preliminary suggested Parts List will be provided with or before acceptance of the Pilot Bus.

**TS 12.2.5 Vehicle Parts Control Configuration – Master Control List**
The Contractor shall provide a master control parts and configuration list due at the first production bus for every year of build covered by this Contract specification. The configuration list shall be formatted and implemented using Microsoft-Excel™ spreadsheet(s). The data list shall include all parts and devices that constitute vehicle construction, consumables excepted.

The Microsoft-Excel™ spreadsheet document shall be arranged to indicate all parts and systems to referenced drawings number(s) supplied elsewhere by this Contract and upon revision, super-cession or any other change made by the Contractor, their subcontractor, hireling’s et al, and/or SEPTA, the Contractor shall resubmit the Microsoft-Excel™ spreadsheet control/configuration document with said changes to document as follows:

i. Change from-to part number/Reference to SEPTA Inventory Control Class and Lot sys.
ii. Reason for change
iii. Reference Drawing number
iv. Affected Systems/subsystems
v. Vendor List
vi. Software/Firmware-License Change
All categories shall be linked using cell drop downs that shall provide a method of tracking all changes as defined herein.

Upon delivery of succeeding first production/first article buses, the Contractor shall revise the Microsoft-Excel™ spreadsheet document. Additionally, the Contractor shall provide a change only list that can be checked against the revised master list(s).

SEPTA inspectors (at Contractor’s Facility) shall be provided a hard paper, copy(s) of the initial and subsequent lists, and change lists due at first article/pilot presentation to SEPTA’s inspectors. Any undocumented deviations, omissions and like errors shall be corrected prior to the acceptance of the current bus.

SEPTA AE&M and Purchasing Departments may conduct master control list configuration audits, the purpose of which will be to determine the accuracy of the submitted Master Control List. The Contractor shall be notified in writing immediately prior to the subject audit. Inaccuracies, errors and like circumstances, that are solely deemed by SEPTA to be consequential, shall be submitted to SEPTA’s procurement management and New Vehicle Programs Project Manager for action that may include the extension of retainage specified throughout this document.

**TS 12.3 Capital Spares Identification**

All capital spare parts, units and assembles and training aids shall be arranged with a 5” in height printed reflective self adhesive tape as follows:

Project code color-Red Project Contract number-
   a.) Tape shall have project contract number printed
   b.) Tape shall be deployed along the container’s horizontal axis

The Contractor shall ensure all parts, units and assembles drop shipped from originated supplier sources shall meet the requirements of this section in labeling conformity.
SECTION 7

WARRANTY REQUIREMENTS
SECTION 7: WARRANTY REQUIREMENTS


WR 1.1 Basic Provisions
WR 1.1.1 Warranty Requirements
WR 1.1.1.1 Contractor Warranty
WR 1.1.1.2 Complete Bus
WR 1.1.1.3 Body and Chassis Structure
WR 1.1.1.4 Propulsion System
WR 1.1.1.5 Major Subsystems
WR 1.1.1.5.1 Major Subsystems and Components
WR 1.1.1.6 Extension of Warranty
WR 1.1.2 Voiding of Warranty
WR 1.1.3 Exceptions and Additions to Warranty
WR 1.1.4 Detection of Defects
WR 1.1.5 Scope of Warranty Repairs
WR 1.1.6 Fleet Defects
WR 1.1.6.1 Occurrence and Remedy
WR 1.1.6.2 Exceptions to Fleet Defect Provisions
WR 1.2 Repair Procedures
WR 1.2.1 Repair Performance
WR 1.2.2 Repairs By Contractor
WR 1.2.3 Repairs By SEPTA
WR 1.2.3.1 Parts Used
WR 1.2.3.2 Contractor Supplied Parts
WR 1.2.3.3 Defective Components Return
WR 1.2.3.4 Failure Analysis
WR 1.2.3.5 Reimbursement For Labor
WR 1.2.3.6 Reimbursement For Parts
WR 1.2.3.7 Reimbursement Requirements
WR 1.2.4 Warranty After Replacement/Repairs
SECTION 7: WARRANTY REQUIREMENTS


WR 1.1 Basic Provisions

WR 1.1.1 Warranty Requirements

WR 1.1.1.1 Contractor Warranty
Warranties in this document are in addition to any statutory remedies or warranties imposed on the Contractor. The Contractor assumes full responsibility for the execution of the warranty for this order of transit buses. Consistent with this requirement, the Contractor warrants and guarantees to SEPTA each complete bus, and specific subsystems and components as follows.

WR 1.1.1.2 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 except as noted in paragraphs WR 1.1.1.3, WR 1.1.1.4 and WR 1.1.1.5, whichever comes first, beginning on the date of acceptance of each bus under "Acceptance of Bus" (Section 3 – Contract and General Conditions, GC 5.1.5). The warranty is based on regular operation of the bus under the operating conditions prevailing in the SEPTA locale.

WR 1.1.1.3 Body and Chassis Structure
Body, *body structure, and **structural elements of the suspension are warranted to be free from Defects, Related Defects, and to maintain structural integrity for three years or 150,000 miles, whichever comes first.

*Body structure refers to the interior panels, sheet metal, all passenger seating, driver’s seat, flooring, plumbing, window glazing, stanchions, etc.

**Primary load carrying members of the bus structure, including structural and non-wear 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 (twelve) years or 500,000 miles, whichever comes first.

WR 1.1.1.4 Propulsion System
Propulsion system components, specifically the engine, drive unit, traction generator and motor, input/output gearings and couplings, engine emissions control systems; including diesel exhaust filtering, aftertreatment, and/or fluid additives (DEF) systems, or other method as mandated by regulation to obtain certification(s), shall be warranted to be free from Defects and Related Defects for a minimum of five years or 300,000 miles, whichever comes first.
The powertrain system components, in addition to supplied items noted in previous paragraph of this section are the traction motor drive system with all gear reduction systems, inverter unit(s), generator(s), traction motor(s), transmission/drive units coolers, shafts, and other components, all electrical and electronic controls including wiring harnesses, (external, internal and interconnecting) system controllers, and software updates necessary for a complete system; including the Energy Storage System, except where specified or modified Table A. The hybrid configuration shall be warranted to be free from defects and related defects for five years or 300,000 miles, whichever comes first.

WR 1.1.1.5 Major Subsystems

WR 1.1.1.5.1 Major Subsystems and Components
Major subsystems shall be warranted to be free from Defects and Related Defects, for three years or 150,000 miles, or where modified by table A-whichever comes first.

Major Bus Subsystems include:

<table>
<thead>
<tr>
<th>TABLE A</th>
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<tbody>
<tr>
<td>Air compressor and dryer-Electric unit shall be Five (5) years</td>
</tr>
<tr>
<td>Alternator/ Charging Unit</td>
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<tr>
<td>AMDT/ASAS/On-Board Diagnostics</td>
</tr>
<tr>
<td>Auxiliary Heater</td>
</tr>
<tr>
<td>Brake system; incl. Foundation brake</td>
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<tr>
<td>Destination Sign System/OCU/ Twelve 12 Years</td>
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<tr>
<td>Doors systems-Electric motor shall be warranted for Five (5) years</td>
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<tr>
<td>Pneumatic System</td>
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<tr>
<td>LED Lighting Twelve (12) years</td>
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<tr>
<td>Engine Fuel &amp; Injection System</td>
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<tr>
<td>Drive and Non-Drive Axles</td>
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<tr>
<td>Windshield Wipers/Washers</td>
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<tr>
<td>PA &amp; Radio Communication Systems</td>
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<tr>
<td>Propulsion Energy Storage ESS ninety six 96 Months/8 Years no mileage limit</td>
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<tr>
<td>LVDC Battery Management system (Incl. EQ systems and LVDC batteries) Five (5) years</td>
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<tr>
<td>Fire Suppression Systems (AFSS)</td>
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<tr>
<td>Driver Defroster Heater</td>
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<tr>
<td>Turbo Charger</td>
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<tr>
<td>Hydraulic Pump(s)</td>
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<tr>
<td>HVAC system</td>
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<tr>
<td>Radiator</td>
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<tr>
<td>Starter</td>
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<tr>
<td>Automatic Passenger Counter</td>
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<tr>
<td>Propulsion Thermal Management /Cooling System(s)</td>
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<tr>
<td>Fuel Tank(s)/DEF Systems</td>
</tr>
<tr>
<td>Wheelchair ramp system(s)</td>
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<tr>
<td>Interior/Exterior Displays</td>
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<tr>
<td>Vehicle Multiplex Systems</td>
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<tr>
<td>Video Surveillance</td>
</tr>
<tr>
<td>AVL / AVM</td>
</tr>
</tbody>
</table>

Brake Lining shall be warranted per the table below:

<table>
<thead>
<tr>
<th>Diesel/Hybrid Front Disc Pad Pad Life</th>
<th>Diesel/Hybrid Front Disc Rotor life</th>
<th>Diesel/Hybrid Rear Axle Disc Pad Life</th>
<th>Diesel/Hybrid Rear Axle Disc Rotor Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>80,000/100,000 Miles</td>
<td>145,000 Miles</td>
<td>40,000/60,000 Miles</td>
<td>60,000 Miles</td>
</tr>
</tbody>
</table>
WR 1.1.1.6 Extension of Warranty
If, during the warranty period, repairs or modifications on any bus, made necessary by defective design, materials or workmanship are not completed due to lack of material or inability to provide the proper repair for 30 (thirty) calendar days, the applicable warranty period shall be extended by the number of days equal to the delay period.

WR 1.1.2 Voiding of Warranty
The warranties shall not apply to the failure of any part or component of the bus that directly results from misuse, negligence, accident, or repairs not conducted in accordance with the Contractor provided; maintenance manuals, training programs, instruction, models, mock-ups, diagrams, parts catalogs, etc. and with workmanship performed by adequately trained personnel in accordance with recognized standards of the industry. The warranty shall also be void if SEPTA fails to conduct scheduled preventive maintenance as recommended in the Contractor's approved maintenance manuals and that omission caused the part or component failure.

WR 1.1.3 Exceptions and Additions to Warranty
The warranties shall not apply to the following items; scheduled maintenance items, normal wear-out items (excluding brake lining), and items furnished by SEPTA such as radio, fare collection, and other auxiliary equipment except if such equipment may be damaged by the failure of a part or component for which the Contractor is responsible.

The Contractor shall notify and pass on to SEPTA any warranties offered by a component supplier that are superior to that required herein.

WR 1.1.4 Detection of Defects
SEPTA detects a Defect within the warranty periods defined in "Warranty Requirements" (WR 1.1.1), it shall within 60 (sixty) business days, notify the Contractor's representative. Within five (5) business days after receipt of notification, the Contractor's representative shall either agree that the Defect is in fact covered by warranty, or reserve judgment until the subsystem or component is inspected by the Contractor's representative or is removed and examined at SEPTA’s property or at the Contractor's plant. The Contractor will be responsible for warranty resolution including related towing or other transportation costs. Warranty coverage on the subsystem or component shall be mutually resolved solely between SEPTA and the Contractor. Work shall commence to correct the Defect within 10 (ten) working days after receipt of notification and shall be conducted in accordance with "Repairs by Contractor" (WR 1.2.2).

WR 1.1.5 Scope of Warranty Repairs
When warranty repairs are required, SEPTA and the Contractor's representative shall agree within five (5) calendar days after notification on the most appropriate course for the repairs and the exact scope of the repairs to be performed under the warranty. If no agreement is obtained within the five-day period,
SEPTA or its designated representative reserves the right to commence the repairs in accordance with "Repairs by SEPTA" (WR 1.2.3).

**WR 1.1.6 Fleet Defects**

**WR 1.1.6.1 Occurrence and Remedy**

A fleet defect is defined as cumulative failure, retrofit, recall, modification, or campaign of any kind in the same components in the same or similar application where such items covered by the warranty and such failure, retrofit, recall, modification, or campaign, which affects twenty (20) percent of the buses delivered under this contract.

SEPTA will declare a Fleet Defect if any of the following occur: a) failures of the same component, or LRU (Line Replaceable Unit; the lowest replacement unit to maintain the bus serviceable for revenue operations) in the same application exceeds a failure rate of twenty (20) percent, during the component warranty period, and/or b) all buses delivered or under warranty do not maintain an aggregate MDBF (Mean Distance Between Failure) of at least 6,000 miles for the duration of the base warranty. The Mean Distance Between Failure is derived from SEPTA’s Vehicle Maintenance Information System; Vehicle Mileage and Road Service Call Failures represents an in-service bus lost time system malfunction or failure of any type.

For example, an LRU is furnished on a bus or purchased, installed and warranted as a unit. Any failure, retrofit, recall, modifications or campaign on that unit under warranty necessitating removal regardless of the cause is handled by the same method; i.e., the entire unit is removed and repaired or replaced by another unit. Furthermore, failures of a speed sensor or a turbo-compressor are considered LRUs of the propulsion system motor or the engine meet the twenty (20) percent removal rate of this Section, SEPTA will declare a fleet defect of the speed sensor or turbo-compressor regardless of failure type; i.e., the unit (component), broken component wiring, connector or software problem that can only be solved with the changing of the unit type currently utilized.

This interpretation applies to all other equipment items specified in the warranty. For components listed below, fleet defect provisions will be applied based on the number of times the component has failed to function normally from a warrantable cause within the period:

<table>
<thead>
<tr>
<th>Air compressor and dryer-Electric unit</th>
<th>Driver Defroster Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternator/ Charging Unit</td>
<td>Turbo Charger</td>
</tr>
<tr>
<td>AMDT/ASAS/On-Board Diagnostics</td>
<td>Hydraulic Pump(s)</td>
</tr>
<tr>
<td>Auxiliary Heater</td>
<td>Hydraulic Steering Unit</td>
</tr>
<tr>
<td>Brake system; incl. Foundation brake</td>
<td>HVAC system</td>
</tr>
<tr>
<td>Destination Sign System/OCU/</td>
<td>Radiator</td>
</tr>
<tr>
<td>Doors systems-Electric motor</td>
<td>Starter</td>
</tr>
<tr>
<td>Pneumatic System</td>
<td>Automatic Passenger Counter</td>
</tr>
<tr>
<td>LED Lighting</td>
<td>Propulsion Thermal Management /Cooling System(s)</td>
</tr>
<tr>
<td>Engine Fuel &amp; Injection System</td>
<td>Fuel Tank(s)/DEF Systems</td>
</tr>
<tr>
<td>Drive and Non-Drive Axles</td>
<td>Wheelchair ramp system(s)</td>
</tr>
<tr>
<td>Windshield Wipers/Washers</td>
<td>Interior/Exterior Displays</td>
</tr>
</tbody>
</table>
The Contractor is responsible to correct a fleet defect under the warranty provisions defined in "Repair Procedures" (WR 1.2). The Contractor will proceed with the remedies as explained in the following paragraph. After correcting the Defect, SEPTA and the Contractor shall mutually agree to and the Contractor shall promptly undertake and complete a work program designed to prevent the occurrence of the same Defect in all other buses, spare parts, and training demonstration units purchased under this contract. Where the specific Defect can be solely attributed to particular identifiable part(s), the work program shall include redesign and/or replacement of only the defectively designed and/or manufactured part(s). In all other cases, the work program shall include inspection and/or correction of all of the buses in the fleet via a mutually agreed to arrangement.

The Contractor shall demonstrate the performance efficacy of the fleet defect correction work program(s). The Contractor shall develop and provide SEPTA the engineering analysis, test data, reliability improvement forecast and on-site system or component testing data to validate the Contractor's work program recommendation. Recommendation Data must be presented to SEPTA for concurrence and milestone submittals.

The Contractor shall provide SEPTA with documentation listing the bus number of each retrofit, campaign and modification work showing start and finish date for each bus and a project completion date. Upon completion of a project, process instructions, Bill of Material(s) and functional checkout procedures will be submitted to the Project Manager within seven business days after the last bus is completed.

For a period not less than one (1) year after completion of a work program, or longer as outlined in “Contractor Warranty” WR 1.1.1.1, the Contractor shall monitor the effectiveness of the work program designed to prevent a re-occurrence of the same defect in the fleet. This period will be used to evaluate the performance of the repair. The status of the defect will remain open during this period until the Contractor has demonstrated the effectiveness of the repair to SEPTA. The warranty on items determined to be fleet defects shall be extended for the duration from the notification by SEPTA of a fleet defect until the work program is completed or as agreed to by SEPTA. This extended warranty shall restart on the date of completion of the repair / replacement work program as agreed to by SEPTA. SEPTA will not perform “fleet defect” repairs under the provisions of this warranty. The Contractor or his representative must perform all repairs to fleet defects.

WR 1.1.6.2 Exceptions to Fleet Defect Provisions

The fleet defect warranty provisions shall not apply to SEPTA supplied items such as fare collection equipment, communication systems, and tires.

Fleet defect warranty provisions shall not apply to defects caused by noncompliance with the Contractor’s normal published maintenance practices and procedures as long as they are not in conflict with this specification. The Contractor shall pass on to SEPTA any warranties offered by a component supplier that are superior to that required herein. The Contractor's published maintenance practices and procedures shall be approved by SEPTA. Maintenance manuals shall be approved by SEPTA.
WR 1.2  Repair Procedures

WR 1.2.1  Repair Performance
The Contractor is responsible for all warranty-covered repair work. The Contractor shall be responsible for the performance of all required warranty work at its sole cost and expense during the warranty period. The Contractor will perform, or have performed, all required warranty work as promptly as possible so as to preclude or minimize any interruptions to, or disruptions of, the operation of normal route service of the buses resulting from delays in the performance of warranty work under this Contract. Bus(es) required to be out-of-service 21 calendar days or more will trigger a retainage notification process that may increase the retainage two (2) percent on the next set of bus invoice(s) per Section 3 - Paragraph GC 8 - Payments; Additional retainage on the remaining buses to be delivered. At its discretion, SEPTA or its designated representative 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 1.2.2  Repairs By Contractor
The Contractor or its designated representative must establish provisions at SEPTA for on-site customer service support and repair staff for the duration of the base warranty for deliveries over fifty (50) buses, begin work on warranty-covered repairs within five (5) working days after receiving notification of a Defect from SEPTA. The Contractor shall perform such work in a timely manner to make the bus available for transit service or other requirements.

The Contractor shall provide at its own expense all parts, tools, and space required to complete repairs. At its discretion, SEPTA may provide shop space to complete repairs, subject to availability. At SEPTA’s option, the Contractor may be required to remove the bus from SEPTA’s property while repairs are being affected. If the bus is removed from SEPTA’s property, the Contractor’s representative must diligently pursue repair procedures. SEPTA will allow a 21 calendar day grace out-of-service period per bus for the respective bus system malfunction attributable to a warranty restoration and or only a total of ten (10) percent of the bus fleet out-of-service allowance of the total bus fleet delivered attributable to all warranty reasons. If the number of buses out-of-service exceeds ten (10) percent, each respective bus number warranty duration will be extended on the buses involved for the their entire out-of-service period each time the same bus number is in a ten (10) percent out of service event.

WR 1.2.3  Repairs By SEPTA

WR 1.2.3.1  Parts Used
If SEPTA performs warranty-covered repairs, it shall correct or repair the Defect and any Related Defects utilizing parts supplied by the Contractor specifically for this repair. At its discretion, SEPTA may use Contractor-specified parts available from its own stock if deemed in its best interest. Monthly, or a period mutually agreed upon, reports of all repairs covered by this warranty shall be submitted by SEPTA to the Contractor for reimbursement or replacement of parts. The Contractor shall use SEPTA's or mutually agreed to forms for these reports.

WR 1.2.3.2  Contractor Supplied Parts
SEPTA may require that the Contractor supply new parts for warranty-covered repairs being performed by SEPTA. These parts shall be ordered by the Contractor and shipped prepaid to SEPTA from any source selected within three (3) business days of receipt of the request for said parts. Parts supplied by the Contractor shall be Original Equipment Supplier (OEM) equivalent or superior to that used in the bus original manufacture. The Contractor shall maintain sufficient stock of spare parts on SEPTA’s property to ensure that no more than ten (10) percent of the fleet is “out-of-service” for repair of any reason at any given time during the warranty period.

WR 1.2.3.3 Defective Components Return
The Contractor may request that failed part covered by the warranty be returned to the manufacturing plant. SEPTA will hold failed parts as requested in writing by the Contractor on an individual basis for seven (7) calendar days from date of replacement of the part for pickup and return to the manufacturer. All other failed parts will be inspected and scrapped locally by SEPTA. Return of failed parts to the manufacturer is the sole responsibility of the Contractor. Warranty claim status and/or duration of warranty coverage shall not be adversely affected for any vehicle or repair made by SEPTA or its designated representative for which the Contractor did not obtain the failed part.

WR 1.2.3.4 Failure Analysis
The Contractor shall, upon specific request of SEPTA, provide a failure analysis of fleet defect- or safety-related parts, or major components, removed from buses under the terms of the warranty, that could affect fleet operation. Such reports shall be delivered within 60 (sixty) days of the receipt of the request.

WR 1.2.3.5 Reimbursement For Labor
SEPTA shall be reimbursed by the Contractor for labor. The amount shall be determined by multiplying the number of man-hours actually required to correct the Defect by a per hour, first (1st) class mechanic, straight wage rate, as defined in "Technical Specifications" (Section 6), plus eighty-four (84) percent fringe benefits; plus the cost of towing and/or retrieval if necessary.

NOTE: The prevailing fringe benefit rate in effect at the time of repair will be utilized. These wage and fringe benefit rates shall not exceed the rates in effect in the SEPTA’s service garage at the time the Defect correction is made. Labor required to correct fleet defects shall be reimbursed by the Contractor at 134% the actual wage rate in effect at the time the campaign is made plus fringe benefits if SEPTA chooses to participate in a fleet defect campaign.

WR 1.2.3.6 Reimbursement For Parts
The Contractor has sole responsibility under this contract to maintain sufficient spare parts in his own stock on SEPTA’s property to support the warranty period requirement. SEPTA has no obligation to provide spare parts to the Contractor for warranty purposes. In the event the Contractor does not have needed spare parts on hand, SEPTA on an individual item basis and in kinds and amounts solely within its discretion may permit its stock of spare parts to be used by the Contractor in performance of warranty work. SEPTA shall be reimbursed by the Contractor for the use of such parts and for parts that must be replaced to correct the Defect. The reimbursement for parts shall be at the current price at the time of repair, as listed in SEPTA’s procurement database, and shall include taxes where applicable and fifteen (15) percent handling costs on parts valued between 0.01 cents and 3,000 dollars. Part value over 3,000
dollars, the material handling cost will be ten (10) percent. Any investment type or regular spare part from SEPTA’s stock that is used to correct a warranty covered defect shall be replaced within fifteen (15) calendar days by the Contractor with a new part of original quality.

WR 1.2.3.7 Reimbursement Requirements
The Contractor shall reimburse SEPTA for warranty covered expenditures within 60 (sixty) days of receipt of warranty claim. Claims that remains as outstanding to SEPTA after this period will become due in full automatically at the end of the current fiscal quarter and may result in withholding of additional retainage on buses covered by this contract.

If the number of buses out-of-service exceeds ten (10) percent of the fleet on account of retrofits, awaiting fleet defect remediation, supplier troubleshooting, awaiting parts, or warranty running repair corrections outside the control of SEPTA, the Contractor may be charged up to $100.00 per day.

WR 1.2.4 Warranty After Replacement/Repairs
If any component, unit, or subsystem is repaired, rebuilt or replaced by the Contractor, or by SEPTA with the concurrence of the Contractor, the component, unit, or subsystem shall have the unexpired warranty period of the original. Repairs shall not be warranted if authorized parts are not used for the repair; unless the Contractor has performed such replacement/repair or has failed to respond within five days, in accordance with "Scope of Warranty Repairs" (WR 1.1.5).

The warranty on items determined to be fleet defects as defined in WR 1.1.6.1 shall be extended for the time and/or miles of the original warranty remaining at the time the fleet defect was identified. This extended warranty shall begin on the repair/replacement date for corrected items on each bus.
SECTION 8

QUALITY ASSURANCE
SECTION 8: QUALITY ASSURANCE


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SECTION 8: QUALITY ASSURANCE


QA 1.1 Contractor’s In-Plant Quality Assurance Requirements

QA 1.1.1 Quality Assurance Requirements
The Contractor shall establish and maintain an effective in-plant quality assurance organization. It shall be a specifically defined organization and be directly responsible to the Contractor's Senior management. The Quality Assurance Organization shall not report to Production Management. The Contractor should maintain a build schedule, if possible, and present buses to SEPTA's Inspector(s) in sequence number order. Schedule changes must be coordinated in a timely manner with the Resident Inspector and reason(s) for the delay(s). Upon notification of a schedule delay, the Contractor shall provide a recovery schedule for presentation to the Resident Inspector and Project Management within 14 Calendar days of the Delay.

QA 1.1.2 Quality Assurance Organization

QA 1.1.2.1 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 1.1.2.2 Authority and Responsibility
The quality assurance organization shall have the authority and responsibility for reliability, quality control, inspection planning, establishment of the quality control system, and acceptance/rejection of materials and manufactured articles in the production of the transit buses.

QA 1.1.3 Quality Assurance Organization Functions

QA 1.1.3.1 Minimum Functions

QA 1.1.3.2 Work Instructions
The quality assurance organization shall verify inspection operation instructions to ascertain that the manufactured product meets all prescribed requirements.

QA 1.1.3.3 Records Maintenance
The quality assurance organization shall maintain and use records and data essential to the effective operation of its program. These records and data shall be available for review by the Resident Inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.

The quality assurance organization shall detect and promptly assure 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 effective supplies, services, facilities, technical data, or standards. Production problems, parts shortages shall be brought to the attention of the Resident Inspector at the stage when they occur rather than at a future stage or when the vehicle is virtually complete.

**QA 1.1.4 Standards and Facilities**

**QA 1.1.4.1 Basic Standards and Facilities**
The following standards and facilities shall be basic in the quality assurance process.

**QA 1.1.4.2 Configuration Control**
The Contractor shall maintain drawings 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 and documentation. Copies of the aforementioned drawings and documents shall be provided to the Resident Inspector for purposes of Configuration and Process Audits. A complete set of build drawings in electronic media shall be supplied to the Resident Inspector prior to assembly of the first bus of each production run. The contractor shall provide updates to said media to reflect as built vehicle.

**QA 1.1.4.3 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.

**QA 1.1.4.4 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.

**QA 1.1.4.5 Equipment Used by Resident Inspectors**
The Contractor's gauges, measuring testing devices and any other tools required 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 1.1.5 Control of Purchases**

**QA 1.1.5.1 Maintenance of Control**
The Contractor shall maintain quality control of purchases.

**QA 1.1.5.2 Supplier Control**
The Contractor shall require that each supplier maintains a quality control program for the services and supplies that it provides. The Contractor's quality assurance organization shall inspect and test materials provided by suppliers for conformance to specification requirements. Materials that have been inspected,
tested and approved shall be identified as acceptable to the point of use in the manufacturing or assembly processes. Controls shall be established to prevent inadvertent use of nonconforming materials.

**QA 1.1.5.3 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 1.1.6 Manufacturing Control**

**QA 1.1.6.1 Controlled Conditions**
The Contractor shall ensure that all basic production operations, as well as all other processing and fabricating, are performed under controlled conditions. Establishment of these controlled conditions shall be based on the documented work instructions, adequate production equipment, and special working environments if necessary.

**QA 1.1.6.2 Completed Items**
A system for final inspection and test of completed transit buses shall be provided by the quality assurance organization. It shall measure the overall quality of each completed bus and have a process improvement procedure in place to eliminate repeated defects.

**QA 1.1.6.3 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.

**QA 1.1.6.4 Statistical Techniques**
Statistical analysis, tests, and other quality control procedures shall be available for review by the Resident Inspector.

**QA 1.1.6.5 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. The Quality Organization shall ensure that the completed transit bus meets all of their Organizations Quality Standards before turning the bus over to the Resident Inspector.

**QA 1.1.6.6 Document and Vehicle Configuration Control**
Once a Production Run/First Article Bus or Pilot Bus Configuration Audit has been accepted by SEPTA representative(s), no subsequent changes are permitted until SEPTA has been fully advised of the reason(s) and compared to the Quality Control Bus for configuration comparison and accepted by SEPTA.

All Contractor design or manufacturing engineering directed changes subsequent to the Bus Configuration Audit such as product improvements effecting the production run buses will be documented and vehicle configuration controlled. All changes will be forwarded immediately on internal origination to the SEPTA site-inspector(s) and fully discussed before any changes are incorporated.

The Quality Control Bus is a SEPTA bus on a delayed delivery schedule to assure product repeatability of following produced buses on production buses or cut-in during a production run.
The engineering documentation and vehicle configuration control requires effective and prompt communication to SEPTA and a Contractor’s schedule for updating and forwarding revised maintenance, servicing, heavy repair, troubleshooting diagrams, parts manuals and issuance of a Customer Advisory Configuration Change Bulletin(s) of the suggested bus modification or supplier change.

**QA 1.1.7 Inspection System**

**QA 1.1.7.1 Inspection System Scope**
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 progress, and completed articles. As a minimum, it shall include the following controls:

**QA 1.1.7.2 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.

**QA 1.1.7.3 Inspection Records**
Acceptance, rework, or rejection identification shall be attached to inspected articles. Articles that have been accepted as a result of approved materials review actions shall be identified. Articles that have been reworked to specified drawing configurations shall not require special identification. Articles rejected as unsuitable or scrap shall be plainly marked and controlled to prevent installation on the bus. Articles that become obsolete as a result of engineering changes by the Contractor, 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 Inspector 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, SEPTA shall approve the modification, repair, or method of correction to the extent that the Contract specifications are affected.

**QA 1.1.7.4 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 SEPTA.

**QA 1.2 Inspections**

**QA 1.2.1 Inspections Stations**

**QA 1.2.1.1 Inspection Location**
Inspection stations shall be at the best locations to provide for work content and characteristics to be inspected. Stations shall provide the facilities and equipment to inspect structural, electrical, hydraulic, and other components and assemblies for compliance with the design requirements. Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. These locations shall minimally include underbody structure completion, body
framing completion, body prior to paint preparation, water test, engine installation completion, underbody
dress-up and completion, bus prior to final paint touchup, bus prior to road test, and bus final road test
completion.

QA 1.2.1.2 Inspection Procedures
A minimum of six in-process inspection stations shall be established by the Contractor at various stages
of manufacturing. As the vehicle completes these stages, the SEPTA Resident Inspector(s) shall be
notified and may elect to inspect the bus at this station. SEPTA shall perform all necessary inspections to
ascertain compliance to specifications or waive the inspection in either case, the contractor shall provide
sufficient time to perform an effective inspection. SEPTA shall only inspect the bus after the Contractor's
Quality Assurance staff has completed their inspection and all deficiencies have been corrected.

QA 1.2.2 Resident Inspector

QA 1.2.2.1 Resident Inspector Role
SEPTA may be represented at the Contractor's or Supplier(s) plant(s) by a Resident Inspector(s). They
shall monitor, in the Contractor's plant, the manufacture of transit buses built under this procurement.
The Resident Inspector(s) will be authorized to approve the pre-delivery acceptance tests and to release
the buses for delivery. Upon request to the Quality Assurance Supervisor, the Resident Inspector(s) shall
have access to the Contractor's quality assurance files related to this procurement. These files shall
include drawings, material standards, parts lists, inspection processing and reports, and records of defects.
No less than 30 days prior to the beginning of bus manufacture, the Resident Inspector(s) shall meet with
the Contractor's Quality Assurance Manager. They shall review the inspection procedures and checklists.
The Resident Inspector(s) may begin monitoring bus construction activities two weeks prior to the start of
bus fabrication. SEPTA Resident Inspector(s) may be assigned to a Supplier's site as necessary. In each
site, the Supplier will furnish and supply to services, and equipment required at the Contractor's plant
identified elsewhere in this QA 1.2.2.

Resident Inspector shall be provided with copies of a complete set of engineering and manufacturing
drawings and documents for the bus being built. Engineering or manufacturing changes must be formally
documented and included in documents provided to SEPTA. These documents include "cut-in" changes
during a production run, authorized material substitutions and production improvement changes. These
documents will be given to the Resident Inspector upon request, authorization date and as noted in QA
1.1.6.5 and QA 1.3.2 of this Section.

The Contractor shall provide office space for the Resident Inspector(s) in close proximity to the final
assembly area. The office space shall be large enough to accommodate a minimum of four (4) people.
This office space shall be equipped with a minimum of four (4) desks, outside and interplant telephones,
fax machine, file cabinets, chairs, and clothing lockers sufficient to accommodate the Resident Inspector
staff.

The Contractor's Resident Inspector(s) office or Supplier(s) site shall be equipped with a Desktop PC
containing Windows 7 and Microsoft Office 2013 or newer software. The office shall have a wireless
Printer/Scanner/Copier (Surface Pro Compatibility) and High Speed Internet Access.

The contractor shall supply SEPTA eight (8) Microsoft Surface Pro – 4th Generation Tablets or newer
with Urban Armor Gear Scout Cases or better (TS 11.3 Special Tools & Other Equipment) for project
management and inspection support. Said tablets shall be equipped with a minimum of 128 GB of
storage and an Intel i5 processor or better. Each tablet shall be delivered with the following accessories: Surface Pro Pen, Surface Pro 4 Docking Station, Surface Pro Keyboard, and Wireless Display Adapter. The contractor shall also supply SEPTA eight (8) pre-paid Mobile Hotspots with LTE capability for use during the duration of the project. Said tablets and hotspots shall be covered with adequate insurance for the duration of the contract, and delivered to SEPTA 90 days prior to the production of the pilot vehicle. The tablets should be pre-loaded and pre-paid with the following applications before delivery:

- Google Drive
- Microsoft Office 365
- Breevy Text Expander
- My Server
- Evernote
- Tape Recorder Pro
- Drawboard PDF – Latest Generation
- Dropbox
- PDF Touch
- Stardock Start8
- Remote Desktop
- InkPad

The presence of the Resident Inspector(s) in the plant shall not relieve the Contractor of its responsibility to meet all of the requirements of this Contract document.

**QA 1.2.2.2 Pre-Production Meetings**

The primary resident inspector shall participate in design review and pre-production meetings with the Procuring Agency. At these meetings the configuration of the buses and the manufacturing processes shall be finalized, and all contract documentation provided to the inspector.

No less than 30 (thirty) days prior to the beginning of bus manufacture, the primary resident inspector shall meet with the Contractor's quality assurance manager and shall 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. The Contractor shall provide a complete Bill of Material prior to the start of bus fabrication.

**QA 1.2.2.3 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.

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, SEPTA shall approve the modification, repair, or method of correction to the extent that the contract specifications are affected.
The primary resident inspector shall remain in the Contractor's plant for the duration of bus assembly work under this contract. Only the primary resident inspector or designee shall be authorized to release the buses for delivery. The resident inspectors shall be authorized to approve the pre-delivery acceptance tests. Upon request to the quality assurance supervisors, the resident inspectors shall have access to the Contractor's quality assurance files related to this procurement. These files shall include drawings, assembly procedures, material standards, parts lists, inspection processing and reports, and records of defects.

**QA 1.3 Acceptance Tests**

**QA 1.3.1 Responsibility**

Fully documented tests shall be conducted on each production bus following manufacture to determine its acceptability to SEPTA. These acceptance tests shall include pre-delivery inspections and testing by the Contractor, and inspections and testing by SEPTA before and after the buses have been delivered. The Pilot bus and the First Production buses shall undergo a Compliance Audit Inspection.

**QA 1.3.2 Pre-Delivery Tests**

A Configuration Audit will be conducted by SEPTA inspection personnel on a Pilot Bus and/or a First Article Inspection of each subsequent production run for SEPTA to verify the bus is built according to the Conformed Contract Documents and previously accepted bus configuration. Variations between the technical specifications and the audit vehicle shall be resolved and corrected before the Audit is completed and accepted. Preproduction meeting concurrence(s) notes and Industry Best Practices will be used as a comparison validation standard be it technical, workmanship or accepted manufacturing standards.

The Contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture and before delivery to SEPTA. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation. The tests shall be conducted and documented in accordance with written test plans. Additional tests may be conducted at the Contractor's discretion to ensure that the completed buses have attained the desired quality and have met the requirements in Section 6 - Technical Specifications. This 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 sufficient 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, or any other tests, shall be filed with the assembly inspection records for each bus. The contractor shall provide a designated area for the purpose of performing pre-delivery inspections by SEPTA. This inspection area shall be equipped with sufficient lighting and all the necessary tools required to conduct a thorough and complete vehicle inspection. The underfloor equipment shall be made 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. Sufficient ceiling clearance shall be available to fully open all rooftop enclosures for inspection. The contractor shall ensure that the inspection area is of adequate size to easily maneuver inspection equipment such as rolling ladders around the bus. The inspection area shall have a minimum of eight (8) feet of clearance around the perimeter of the vehicle. Delivery of each bus shall require written authorization of a 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 1.3.2.1 Inspection – Visual and Measured**
Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing is to verify overall dimensional and weight requirements, to verify that required components are included and are ready for operation, and to verify that components and subsystems that are designed to operate with the bus in a static condition do function as designed.

**QA 1.3.2.2 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 15 miles during the road tests. Observed defects shall be recorded on 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. Results shall be pass/fail for these bus operations tests.

**QA 1.3.3 Post Delivery Tests**
SEPTA shall conduct acceptance tests on each delivered bus. These tests shall be completed within 15 (fifteen) 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 SEPTA. The post-delivery tests shall include visual inspection and bus operations.

Buses that fail to pass the post-delivery tests are subject to non-acceptance. SEPTA shall record details of all defects on the appropriate test forms and shall notify the Contractor of non-acceptance of each bus within 10 days after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in GC 6 of the contract.

**QA 1.3.3.1 Visual Inspection**
The post-delivery inspection is similar to the inspection at the Contractor's plant and shall be conducted with the bus in a static condition. Any visual delivery damage shall be identified and recorded during the visual inspection of each bus.

**QA 1.3.3.2 Bus Operation**
The road tests for total bus operation are similar to those conducted at the Contractor's plant. Operational deficiencies of each bus shall be identified and recorded. In addition, SEPTA may elect to perform chassis Dynamometer tests.

**QA 1.4 Required Tests**

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<td>Contractor shall provide a video demonstrating specification compliance</td>
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<td>SP 1.1</td>
<td>Documentation</td>
<td>Provide documentation; complete sets of as built drawings-structural, chassis, suspension, pneumatic and coolant diagrams, electrical schematics on AutoCad™ on CDR format.</td>
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SECTION 9

FORMS & CERTIFICATIONS
Southeastern Pennsylvania Transportation Authority

FORMS & CERTIFICATIONS

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CER 1 - CERTIFICATION REGARDING LOBBYING

CERTIFICATION REGARDING LOBBYING

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

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an Officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

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

Signature: _____________________________________

Company Name: _____________________________________

Title: _____________________________________

Date: _____________________________________
CER 2 - BUY AMERICA CERTIFICATION

BUY AMERICA CERTIFICATE

Certification requirement for the procurement of buses, other rolling stock, and associated equipment,


The Proposer hereby certifies that it will comply with the requirements of 49 U.S.C. § 5323(j)(2)(C) [formerly Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended] and the regulations of 49 CFR Part 661.11.

Signature: ____________________________________________

Company Name: ____________________________________________

Title: ____________________________________________

Date: ____________________________________________

or


The Proposer hereby certifies that it cannot comply with the requirements of 49 U.S.C. § 5323(j)(2)(C) [formerly Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended] but may qualify for an exception to the requirement consistent with 49 U.S.C. § 5323(j)(2)(B) or (j)(2)(D) [formerly Section 165(b)(2) or (b)(4) of the Surface Transportation Assistance Act, as amended] and the regulations in 49 CFR Part 661.7.

Signature: ____________________________________________

Company Name: ____________________________________________

Title: ____________________________________________

Date: ____________________________________________
CER 3 - DBE APPROVAL CERTIFICATION

DBE APPROVAL CERTIFICATION

I hereby certify that the Proposer has complied with the requirements of 49 CFR Part 26.49, “How are overall goals established for Transit Vehicle Manufacturers”, and that its goals have been either approved or not disapproved by the Federal Transit Administration.

Proposer is required to initial one of the two boxes below:

☐ Approved
☐ Not Disapproved

Signature of
Proposer's Authorized Official:

______________________________

Name and Title of
Proposer's Authorized Official:

______________________________

Company Name:

______________________________

Date:

______________________________
NON-COLLUSION AFFIDAVIT

State of _________________________________) SS:
County of _________________________________)

, being first duly sworn, deposes and says that he/she is authorized to
attest on behalf of himself/herself and is ________________________________
(insert "sole owner", "a partner", or other proper title)
of ______________________________ the offeror submitting this proposal; that such offer was not made in
the interest of or on behalf of any undisclosed person, partnership, company, organization or
corporation; that such offer is genuine and not collusive or a sham; and that said offeror has not been a
party to any agreement to offer a fixed amount or to refrain from offering and has not, directly or
indirectly, by agreement, communication or conference with anyone attempted to induce action
prejudicial to the interests of the Southeastern Pennsylvania Transportation Authority, of any offeror or
anyone else interested in the proposed contract.

Signature: ________________________________
Company: ________________________________
Title: ________________________________
Date: ________________________________
CERTIFICATE OF COMPLIANCE WITH BUS TESTING REQUIREMENT

The undersigned certifies that the vehicles offered in this procurement comply and will, when delivered, comply with 49 U.S.C. § 5323(c) and FTA's implementing regulation at 49 CFR Part 665 according to the indicated one of the following three alternatives.

(mark one and only one of the three blank spaces with an "x")

1.  __ The buses offered herewith have been tested in accordance with 49 CFR Part 665 on (date). The vehicles being sold should have the identical configuration and major components as the vehicle in the test report, which must be submitted with this Offer. If the configuration or components are not identical, the manufacturer shall provide with its Offer a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing.

2.  __ The manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), and submits with this Offer the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

3.  __ The vehicle is a new model and will be tested and the results will be submitted to Procuring Agency prior to acceptance of the first bus.

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

Signature:  

Company Name:  

Title:  

Date:  
CERTIFICATION REGARDING COMPLIANCE WITH IMMIGRATION REFORM AND CONTROL ACT OF 1986

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

1. Contractor has and will continue to comply with, for the duration of this Contract, the requirements of 8 U.S.C. § 1324a with respect to the hiring, recruiting or referral for employment of an alien in the United States of America.

2. Contractor will complete the Employee Eligibility Form (I-9) for each person that it hires, and shall keep each I-9 Form on file for at least three (3) years, or one (1) year after employment ends, whichever is longer.

3. Contractor shall require that the provisions of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when the parties entered into this Contract. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Act 43 of 2006, the Illegal Alien Labor on Assisted Act also known and cited as the Prohibition of Illegal Alien Labor on Assisted Projects Act.

Signature:

Company Name:

Title:

Date:
**CER 7 - FEDERAL MOTOR VEHICLE SAFETY STANDARDS CERTIFICATES**

**Federal Motor Vehicle Safety Standards**

The Proposer and (if selected) Contractor shall submit (1) manufacturer’s FMVSS self-certification sticker information that the vehicle complies with relevant FMVSS or (2) manufacturer’s certified statement that the contracted buses will not be subject to FMVSS regulations.

**Company name:**

**Name of signer:**

**Title:**

Authorized signature ___________________________ Date ___________________________
CER 8 - ACKNOWLEDGEMENT OF ADDENDA FORM

Acknowledgement of Addenda

The following form shall be completed for the acknowledgement of all addenda by inserting the dates next to the appropriate addenda number and including in the Technical Proposal submittal. Failure to properly acknowledge the addenda, as set forth below, may cause your proposal to be considered non-responsive to the solicitation.

The undersigned acknowledges receipt of the following addenda to this RFP No. XX-XXX-XXX and certifies that all changes have been taken into account in the total price of the proposal.

ADDENDUM NO. 1 DATED: ____________
ADDENDUM NO. 2 DATED: ____________
ADDENDUM NO. 3 DATED: ____________
ADDENDUM NO. 4 DATED: ____________
ADDENDUM NO. 5 DATED: ____________
ADDENDUM NO. 6 DATED: ____________

Proposer Name: ________________________________________________________________
Street Address  : ________________________________________________________________
City, State Zip : ________________________________________________________________

Signature of Authorized Signer: _________________________________________________
Print/Type Name : _____________________________________________________________
Phone Number     : ________________________
CER 9 – PERFORMANCE BOND “SAMPLE”

Performance Bond "Sample"

Know all men and women (or persons) by these presents, that ___________________________ as principal (hereinafter called the Contractor) and ___________________________ as Surety (hereinafter called the Surety) are held and firmly bound unto SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY, 1234 MARKET STREET, PHILADELPHIA, PA 19107-3780, as Obligee (hereinafter called SEPTA) in the amount of __________ dollars ($_________), for the payment whereof the said Contractor and Surety bind themselves, and their respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Contractor has by written agreement dated __________ entered into a contract with SEPTA for which contract is hereby referred to and made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, the condition of this obligation is such, that if the Contractor shall fully indemnify SEPTA against any loss or damage directly suffered through the failure of the Contractor to faithfully perform said contract, at the time(s), and in the manner therein specified, then this obligation shall be void; otherwise it shall remain in full force and effect.

Provided however, whenever Contractor shall be, and declared by SEPTA to be in default under the Contract, the Surety may promptly remedy the default, or shall promptly;

1. Complete the Contract in accordance with its terms and conditions, or

2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if SEPTA elects, upon determination by SEPTA and/or the Surety of the lowest responsible bidder, arrange for a contract between such bidder and SEPTA, and make available as work progresses and continue to make available (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term “balance of the contract price,” as used in this paragraph, shall mean the total amount payable by SEPTA to Contractor under the Contract and any amendments or other entitlements thereto, less the amount properly paid by SEPTA to Contractor.
AND PROVIDED FURTHER, that no action, suit or proceeding be instituted on this bond after the expiration of two (2) years from the date on which final payment under the Contract falls due.

Signed, Sealed and Dated this ___ day of ________, 20__.

(Contractor)

BY: __________________________ (SEAL)

(Surety)

BY: __________________________ (SEAL)
CER 10 – MAINTENANCE BOND “SAMPLE”

Maintenance Bond “Sample”

KNOW ALL PERSONS BY THESE PRESENTS, that we, ________________________________,

(Contractor)

(hereinafter called "Principal"), and

______________________________

(Surety Company)

authorized to transact business in the Commonwealth of Pennsylvania, (hereinafter called "Surety"), are held and firmly bound unto the Southeastern Pennsylvania Transportation Authority ("SEPTA") as Obligee, in the penal sum of ________________________________ good and lawful money of the United States of America, for the payment of which well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by written Agreement, dated ________, entered into a contract with SEPTA for the ; and

WHEREAS, the contract requires that the Principal shall furnish a bond in the penalty of 100 percent of the contract price which shall remain in force for a period of ________ year(s) after the date of Final Payment by SEPTA and which shall be conditioned to guarantee against all defects in workmanship and materials which shall become apparent during said period.

NOW, Therefore, The Condition of This Obligation Is Such, that if the Principal shall well and truly repair and replace any defects or deficiency in materials or workmanship which may develop in connection with said work during the period of ____________ year(s) from Final Payment and which have been occasioned by faulty workmanship or defects in materials, then this obligation shall be null and void, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, said Principal and Surety have caused these presents to be signed and their seals to be affixed the day and year first written below.

Signed, Sealed and Dated this ___ day of __________________, 20___.

Contractor:

______________________________

(Authorized Signature) (SEAL)

(Authorized Signature)

Surety Company:

______________________________

(Authorized Signature) (SEAL)

(Authorized Signature)
### CER 11 – CONTRACT CHANGE ORDER FORM “SAMPLE”

**Contract Change Order Form “Sample”**

**SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY**

1234 Market Street Page __ of
Philadelphia, Pennsylvania 19107-780 Date

<table>
<thead>
<tr>
<th>Change Order No.:</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEPTA Fund No. _____</td>
</tr>
<tr>
<td>Contractor:</td>
</tr>
<tr>
<td>CPMS No. __________________</td>
</tr>
<tr>
<td>SEPTA Commitment No:</td>
</tr>
<tr>
<td>Federal Grant No. _______________</td>
</tr>
<tr>
<td>Contract Title:</td>
</tr>
<tr>
<td>Requested by:</td>
</tr>
</tbody>
</table>

**THIS ORDER, WHEN PROPERLY EXECUTED, CONSTITUTES AUTHORIZATION TO PROCEED WITH THE CHANGES DESCRIBED BELOW, AND TO CHANGE THE AMOUNT OF THE CONTRACT AS NOTED.**

<table>
<thead>
<tr>
<th>DESCRIPTION OF CHANGE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ADD</td>
</tr>
<tr>
<td></td>
<td>DEDUCT</td>
</tr>
</tbody>
</table>

All terms, covenants and conditions of the original Agreement dated ______________ with amendments to date, if any, remain in full force and effect except as herein stated.

Contractor does hereby acknowledge that the increase in the Contract Sum, as set forth in this Change Order, shall be in full and complete satisfaction of all indebtedness and obligation of any nature whatsoever for the additional services performed or to be performed under this Change Order, and that such increase includes any and all costs for inefficiency, disruption or delay associated with such additional services. Contractor, for itself, its successors and assigns hereby remises, releases and forever discharges SEPTA of and from all manner of debts, demands, claims, actions, causes of action, suits, accounts, covenants, contracts, agreements and any and all claims and liabilities whatsoever, in law and in equity, arising under or by virtue of this and any other Change Orders.
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY

1234 Market Street
Philadelphia, Pennsylvania 19107-3780

CONSULTING SERVICES

SEPTA Fund No. ______ Contractor:

CPMS No. ________________ SEPTA Commitment No:

Federal Grant No. ________________ Contract Title:

Requested by:

A. Original Value of Contract $____
B. Previous Change Orders $____
C. This Change $____
D. New Contract Sum (A + B + C) $____ (Not to exceed)
E. % Change - This Change (C / A) __%
F. Cumulative % Change ([B + C] / A) __%
G. Cumulative $ Change (B + C) $____

APPROVALS: This change order made subject to Resolution adopted by the SEPTA Board on (date to be inserted is that of adoption of original authorizing resolution for contract), incorporated by reference herein.

Is specific SEPTA Board Approval Required YES NO, if YES Date of Approval______.

Is Funding Agency Approval Required YES NO, if YES Date of Approval______.

SEPTA CONTRACT ADMINISTRATOR

PROJECT MANAGER

PROJECT MANAGER

SEAL:

GENERAL MANAGER

PRESIDENT, VICE PRESIDENT

ATTEST:

SECRETARY

SECRETARY, ASST. SECRETARY

TREASURER, ASST. TREASURER

APPROVED AS TO FORM:

BY: ______________________ Esq.

GENERAL COUNSEL’S OFFICE
SECTION 11 - APPENDICES

1) APPENDIX 1: VEHICLE DESIGN & SPECIFICATION FORMS FOR DIESEL-ELECTRIC HYBRID BUS

2) APPENDIX 2 – PRICE PROPOSAL

3) APPENDIX 3 - PROJECT PROGRESS AND PERFORMANCE EVALUATION FORM

4) APPENDIX4 - SEPTA PROTEST PROCEDURES

5) APPENDIX 5 – FAREBOX INFORMATION

6) APPENDIX 6 – SEPTA INTERIOR & EXTERIOR BUS GRAPHICS
APPENDIX 1 - VEHICLE DESIGN AND EQUIPMENT SPECIFICATION FORM

40’ LOW FLOOR DIESEL-ELECTRIC HYBRID BUS

Instructions: Proposer shall supply and complete all items included in this technical submission requirement offer.

The Proposer shall submit for review by SEPTA a completely filled-in Vehicle Design and Equipment Specification form below to confirm the proposed vehicle and components are in compliance with the requirements of Section 6: Technical Specifications of the Contract.

A. BUS MANUFACTURER
   ________________________________
   Bus Model: __________________

B. UNDERSTRUCTURE MANUFACTURER
   _____________________________
   Model Number: ________________

C. BASIC BODY CONSTRUCTION
   1. Type: ________________
   2. Tubing or frame member Thickness & Dimensions
      a. Overstructure: ________________
      b. Understructure: ________________
      c. Tube Interior Rust Inhibitor Manufacturer/Material: _____ / _____
      d. Undercoating Manufacturer/Material: _____ / _____
   3. Skin Thickness and Material
      a. Roof: ________________
      b. Sidewall: ________________
      c. Skirt Panel: ________________
      d. Front End: ________________
      e. Rear End: ________________

D. DIMENSIONS
   1. Overall Length
      a. Over Bumpers: ________Ft. _______In.
      b. Over Body: ________Ft. _______In.
2. Overall Width
   a. Over Body excluding Mirrors _________ In.
   b. Over Body including Mirrors - driving position _________ In.
   c. Over Tires Front Axles _________ In.
   d. Over Tires Rear Axles _________ In.

3. a. Over all Height (maximum) _________ In.
    b. Overall Height (main roof line) _________ In.


5. Breakover Angle _________ Deg.

6. Angle of Departure _________ Deg.

7. Doorway Dimensions
   Front   Rear
   a. Width Between Door Posts ______ in    ______ in
   b. Door Width Between Panels ______ in    ______ in
   c. Clear Door Width ______ in    ______ in
   d. Doorway Height ______ in    ______ in
   e. Knuckle Clearance ______ in    ______ in

8. Step Height from Ground (measured at center of doorway)

   Front Doorway   Ramp Angle   Rear Doorway
   (Kneeled)   a._______ inches   R1_______ deg.   a.____________ inches
   (Unkneeled) b._______ inches   R2_______ deg.   b.____________ inches
9. Interior Head Room (center of aisle)
   a. Front Axle Location _________ In.
   b. Drive Axle Location _________ In.

10. Aisle Width Between Transverse Seats (minimum) _________ In.

11. Floor Height Above Ground (centerline of bus)
   a. at Front door _________ In.
   b. at Front Axle _________ In.
   c. at Drive Axle _________ In.
   d. at Rear door _________ In.

12. Minimum Ground Clearance (between bus and ground, with bus unkneeled)
   a. Excluding Axles _________ In.
   b. Including Axles _________ In.
   c. Lowest point under bus _________ In.

13. Horizontal Turning Envelope (see diagram below)
   a. Outside Body Turning Radius, TR0 (including bumper) _______ Ft. _________ In.
   b. Front Inner Corner Radius, TR1 _______ Ft. _________ In.
   c. Front Wheel Inner Turning Radius, TR2 _______ Ft. _________ In.
   d. Front Wheel Outer Turning Radius, TR3 _______ Ft. _________ In.
e. Inside Body Turning Radius, TR4 (including bumper) ________Ft. ________In.

14. Wheelbase ________In.

15. Overhang, Centerline of Axle Over Bumper
   a. Front ________Ft. ________In.
   b. Rear ________Ft. ________In.

16. Floor
   a. Interior Length ________Ft. ________In.
   b. Interior Width (excluding coving) ________Ft. ________In.
   c. Total Standee Area ________Sq. Ft.
   d. Minimum distance between Wheelhouses:
      Front: ________In.
      Rear: ________In.
   e. Maximum interior floor slope (from horizontal) ________Deg.

17. Passenger Capacity Provided
   a. Total Maximum Seating ________
   b. Standee Capacity ________
Southeastern Pennsylvania Transportation Authority

c. Minimum Knee to Hip Room
   Curb Side _________ In.
   Street Side _________ In.
   Family Seat _________ In.

d. Minimum Foot Room _________ In.

E. WEIGHT OF BUS

<table>
<thead>
<tr>
<th>No. of People</th>
<th>Front Axle</th>
<th>Rear Axle</th>
<th>TOTAL BUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Empty Bus Full Fuel</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully Seated Full Fuel</td>
<td>+ Driver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fully Loaded Standee and Fully Seated Full Fuel</td>
<td>+ Driver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crush Load (1.5xFully Loaded)</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GVWR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAWR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F. ENGINE, MAIN

1. Manufacturer

2. Type

3. Model Number

4. No. of Cylinders

5. Bore _________ In.


8. Compression Ratio

---

Appendix 1 (40-Foot Hybrid) Initial Issue Page 5 of 24
### 9. Injector Type and Size

### 10. Net S.A.E. Horsepower

\[ \text{\#\# HP at \#\# RPM} \]

### 11. Net S.A.E. Torque

\[ \text{\#\# lb. ft. at \#\# RPM} \]

### 12. Crankcase Oil Capacity

- a. New Engine, dry
  \[ \text{\#\# gals.} \]
- b. New Engine, wet
  \[ \text{\#\# gals.} \]

### 13. Turbocharger, Make & Model

### 14. Maximum Speed, no load

\[ \#\# \text{ RPM} \]

### 15. Maximum Speed, full load

\[ \#\# \text{ RPM} \]

### 16. Speed at Idle

\[ \#\# \text{ RPM} \]

### 17. Speed at Fast Idle

\[ \#\# \text{ RPM} \]

### 18. Engine Information/graphs to be attached with this form:

- Engine speed vs. road speed
- Torque vs. engine speed
- Horsepower vs. engine speed
- Fuel consumption vs. engine speed.
- Vehicle speed vs. time (both loaded and unloaded)
- Vehicle speed vs. grade (both loaded and unloaded)
- Acceleration vs. time
- Change of acceleration vs. time.
- Change of deceleration vs. time.

### G. POWER TRAIN (Hybrid Configuration)

#### 1. Traction Motor/Transmission

- **Q.** Manufacturer
  
  
- **R.** Type
  
  
- **S.** Model
  
  
- **T.** Traction Motor Horsepower
  
  
- **U.** Type Ventilation/Cooling
  
  
- **V.** Weight
  
  
#### 2. Cooling System (Traction Motor/Transmission)

- **a.** Manufacturer
### Static Convertor (HV/LVDC) (If Applicable)

1. Manufacturer

2. Model

3. Inverter Technology

4. Weight

5. Output Voltage

6. Output Current

### HVAC Static Convertor (HV/LVDC) (If Applicable)

1. Manufacturer

2. Model

3. Inverter Technology

4. Weight

5. Output Voltage

6. Output Current

### Voltage Regulator

1. Manufacturer

2. Model

### Voltage Equalizer

1. Manufacturer
### L. ALTERNATOR

1. Manufacturer
   - _________________________________
2. Type
   - _________________________________
3. Model
   - _________________________________
4. Output at Idle
   - ___________Amps
5. Output at Maximum Speed
   - ___________Amps
6. Maximum Waranted Speed
   - ___________rpm
7. Speed at Idle
   - ___________rpm
8. Drive Type
   - ___________rpm

### M. STARTER MOTOR

1. Manufacturer
   - _________________________________
2. Type
   - _________________________________
3. Model
   - _________________________________

### N. AIR COMPRESSOR

1. Manufacturer
   - _________________________________
2. Type
   - _________________________________
3. Rated Capacity
   - ___________ cfm
4. Capacity, at Idle
   - ___________ cfm
5. Capacity, at Maximum Speed
   - ___________ cfm
6. Maximum Warranted Speed
   - ___________ rpm
7. Speed Idle
   - ___________rpm
8. Drive Type
   - ___________rpm
9. Governor
   a) Cut-in Pressure
      - ___________psi
   b) Cut-Out Pressure
      - ___________psi
10. Mechanical / Electric Drive
    a. Electronically Controlled
       - Yes  No
11. Duty Cycle
Southeastern Pennsylvania Transportation Authority

a) Rated Duty Cycle _____________%
b) Calculated for this Application _____________%

12. Electrically-Driven Air Compressor (if Applicable)
   1. Electric Drive
      a. Manufacturer ________________________________
      b. Model number ________________________________

   2. Voltage/Power Ratings

   3. Compressor
      a. Manufacturer ________________________________
      b. Model Number ________________________________
      c. Type Pump ________________________________
      d. Rated Capacity @ RPM. ________________________________

O. AXLE, FRONT
   1. Manufacturer ________________________________
   2. Type ________________________________
   3. Model Number ________________________________
   5. Axle Load _____________lbs.

P. AXLE, REAR
   1. Manufacturer ________________________________
   2. Type ________________________________
   3. Model Number ________________________________
   5. Axle Load _____________lbs.
   6. Axle Ratio ________________________________
   7. MTTR {application specific} _____________miles

Q. SUSPENSION SYSTEM
   1. Manufacturer ________________________________
   2. Type: Front ________________________________
   Rear ________________________________
3. Springs: Front _________________________________
   Rear _________________________________

4. Leveling Valve System
   Valve
   a) Type _________________________________
   b) Model _________________________________

R. WHEELS AND TIRES
   c) Wheels
      a. Make _________________________________
      b. Size _________________________________
      c. Capacity _______________________________ lbs.
      d. Material _______________________________
   d) Tires
      a. Type _________________________________
      b. Size _________________________________
      c. Load Range/Air Press. _______________________________ lbs/p.s.i.

S. STEERING, POWER
   1. Pump
      a. Manufacturer & Model No. _________________________________
      b. Type _________________________________
      c. Relief Pressure __________ psi
      d. Pressure Range
         1) @ Max RPM __________ psi
         2) Operating Pressure Range __________ psi
      e. Hydraulic Lines
         1) Working Pressure __________ psi
         2) Burst Pressure __________ psi
      
      3) Impulse CPM-Hz./Max Duration __________/___________
      
      f. Pump Location
      g. Pump Electric Drive E
         a. Manufacturer ________________________________
### Steering Gear

2. **Steering Gear**
   
   a. **Manufacturer & Model No.**
   
   b. **Type**
   
   c. **Ratio**

### Power Steering Fluid Capacity

3. **Power Steering Fluid Capacity**

### Maximum Effort at Steering Wheel

4. **Maximum Effort at Steering Wheel**
   
   (unloaded stationary coach on dry asphalt pavement)

### Steering Wheel Diameter

5. **Steering Wheel Diameter**

### BRAKES

T. **BRAKES**

1. **Make of Foundation Brake System**

2. **Brake Chambers Vendor's Size & Part No.**
   
   a. **Front**
   
   b. **Rear**

3. **Brake Operation Effort**

4. **Slack Adjuster's Vendor's Type & Part No.**
   
   a. **Front**
      
      1) **Right**
      
      2) **Left**
   
   b. **Rear**
      
      1) **Right**
      
      2) **Left**

   c. **Length**
      
      1) **Front Take-up**
      
      2) **Rear Take-up**

5. **Brake Discs/Drum Lining (If Applicable)**
   
   a. **Front**
      
      1) **Manufacturer**
      
      2) **Part Number**
      
      3) **Diameter**
b. Rear
   1) Manufacturer _____________________________
   2) Part Number _____________________________
   3) Diameter _____________ In.

6. Brake Pad Lining Manufacturer _____________________________
   1) Type & FMSI #’s _____________________________
   2) Additional Manufacturer and FMS#’s _____________________________

7. Brake Pad Lining Identification
   a. Front
      1) Left - Inner/Outer _____________________________
      2) Right - Inner/Outer _____________________________
   b. Rear
      1) Cam or Left – Inner/Outer _____________________________
      2) Anchor or Right – Inner/Outer _____________________________

8. Brake Pad Lining Per shoe
   a. Front _____________________________
   b. Rear _____________________________

9. Brake Pads Lining Widths
   a. Front _____________ In.
   b. Rear _____________ In.

10. Brake Pads Lining Lengths
    a. Front _____________ In.
    b. Rear _____________ In.

11. Brake Pads Lining Thickness _____________ In.

12. Brake Pads Lining Area Per Axle
    a. Front _____________ Sq. In.
    b. Rear _____________ Sq. In.

13. Brake Pads Life
    a. Front _____________ miles
Southeastern Pennsylvania Transportation Authority

b. Rear _____________miles

14. ABS/ATC Systems
   1. ABS (Automatic Brake System)
      a. Manufacturer _______________________________
      b. Model Number _______________________________
   2. ATC (Automatic Traction Control)
      a. Manufacturer _______________________________
      b. Model Number _______________________________

U. COOLING SYSTEM
   1. Radiator/Charge Air Cooler
      a. Manufacturer _______________________________
      b. Type _______________________________
      c. Model Number _______________________________
      d. Number of Tubes _______________________________
      e. Tubes Outer Diameter __________In./__________In.
      f. Fins Per Inch __________ Fins/__________Fins
      g. Fin Thickness __________In./__________In.
   2. Total Cooling and Heating System Capacity _____________Gals
   3. Radiator V/CAC Fans
      a. # of Fans RAD CAC
      b. Max RPM _____________ RPM
      c. Max Current Draw _____________ AMPS
      d. Control Scheme __________________
   4. Surge Tank, Capacity _____________Qts.
   5. Engine Thermostat Temperature Setting
      a. Initial Opening _____________ ° F
      b. Fully Closed _____________ ° F
   6. Overheat Alarm Temperature Sending Unit Setting _____________ ° F
   7. Shutdown Temperature Setting _____________ ° F

V. AIR RESERVOIR CAPACITY
   Mechanical Electric Drive
   (Configuration)
<table>
<thead>
<tr>
<th></th>
<th>Supply Reservoir</th>
<th>_________ Cu. In.</th>
<th>_________ Cu. In.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Primary Reservoir</td>
<td>_______ Cu. In.</td>
<td>_______ Cu. In.</td>
</tr>
<tr>
<td>3</td>
<td>Secondary Reservoir</td>
<td>_______ Cu. In.</td>
<td>_______ Cu. In.</td>
</tr>
<tr>
<td>5</td>
<td>Accessory Reservoir</td>
<td>_______ Cu. In.</td>
<td>_______ Cu. In.</td>
</tr>
<tr>
<td>6</td>
<td>Other Reservoir</td>
<td>_______ Cu. In.</td>
<td>_______ Cu. In.</td>
</tr>
</tbody>
</table>

**W. HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT**

<table>
<thead>
<tr>
<th></th>
<th>Heating System Capacity</th>
<th>_________ B.T.U.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Air Conditioning Capacity</td>
<td>_________ B.T.U.</td>
</tr>
<tr>
<td>3</td>
<td>Ventilating Capacity</td>
<td>_________ cfm</td>
</tr>
<tr>
<td>a</td>
<td>CFM at Windows</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>1) Winter</td>
<td>_________ cfm</td>
</tr>
<tr>
<td></td>
<td>2) Summer</td>
<td>_________ cfm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Compressor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Manufacturer &amp; Model</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Type</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>No. of Cylinders</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Drive Ratio</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>Maximum Warranted Speed</td>
<td>_________ r.p.m.</td>
</tr>
<tr>
<td>f</td>
<td>Operating Speed</td>
<td>_________ r.p.m.</td>
</tr>
<tr>
<td>g</td>
<td>Weight</td>
<td>_________ lbs.</td>
</tr>
<tr>
<td>h</td>
<td>Oil Capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Dry</td>
<td>_________ gals.</td>
</tr>
<tr>
<td></td>
<td>2) Wet</td>
<td>_________ gals.</td>
</tr>
<tr>
<td>i</td>
<td>Refrigerant</td>
<td>_________ Type _________ Lbs.</td>
</tr>
<tr>
<td>j</td>
<td>Power Source</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Mechanical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Electrical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manufacturer</td>
<td></td>
</tr>
</tbody>
</table>
5. Condenser
   a. Manufacturer & Model
   b. No. of Rows
   c. No. of Fins/In.
   d. O.D. of Tube
   e. Fin Thickness

6. Condenser Fan
   a. Manufacturer & Model
   b. Fan Diameter
   c. Speed Maximum
   d. Flow Rate (maximum)
   e. Operating Voltage

7. Receiver
   a. Manufacturer & Model
   b. Capacity

8. Condenser Fan Drive Motors
   a. Manufacturer
   b. Model
   c. Type
   d. Horse Power
   e. Operating Speed
   f. Overload Temperature
   g. Motor Ratings AC/DC

9. Evaporator Fan Drive Motors
   a. Manufacturer
   b. Model
   c. Type
   d. Horse Power
Southeastern Pennsylvania Transportation Authority

e. Operating Speed ________________ r.p.m.
f. Overload Temperature ________________
g. Motor Ratings AC/DC Voltage _____ Phase _____ Ampere _____

10. Evaporator(s)
   a. Manufacturer & Model ______________________________
   b. Number of Rows ______________________________
   c. No. of Fins/In. ______________________________
   d. Outer Diameter of Tube ______________ In.
   e. Fin Thickness ______________ In.
   f. Number of Evaporator Cores ______________

11. Expansion Valve
    Manufacturer & Model ______________________________

12. Filter-Drier
    Manufacturer & Model ______________________________

13. Heater Elements
   a. Manufacturer & Model ______________________________
   b. Capacity ______________ B.T.U.
   c. Type ______________________________
   d. Number of Tubes ______________________________
   e. Fins per inch ______________________________

14. Controls
   a. Manufacturer & Model ______________________________
   b. Type ______________________________
   c. Software Design ______________________________

15. Driver's Heater
   a. Manufacturer ______________________________
   b. Model No. ______________________________
   c. Capacity ______________ B.T.U.
   d. Motor Voltage _____ Phase _____ Power _____
   e. Voltage Rating ______________________________
Southeastern Pennsylvania Transportation Authority

f. Power Rating

16. Ventilation System
   Type

   Motors

   1) Type

   2) Model

   3) Voltage/Power

      _____ Volts _____KW/Motor

17. Floor Heaters
   Make & Model

   Power Rating (if electric)

   Capacity (B.T.U)          __________  __________ B.T.U.

   Voltage Rating (if electrical)

X. INTERIOR LIGHTING

1. Manufacturer

2. Type

3. Number of Fixtures

4. Size of Fixtures

Y. DOORS

1. Front
   a. Manufacturer of Operating Equipment
   b. Type of Door
   c. Type of Operating Equipment

2. Rear
   a. Manufacturer of Operating Equipment
   b. Type door
   c. Type of Operating Equipment

3. Door Manufacturer
   a. Front
   b. Rear
Z. **PASSENGER WINDOWS**

1. **Manufacturer**

2. **Model**

3. **Type**

4. **Number:**
   - (Side)
   - (Rear)

5. **Sizes:**

6. **Glazing:**
   - **Type**
   - **Thickness**
   - **Color of Tint**
   - **Light Transmission (UV Factor)**

AA. **MIRRORS**

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Mfg. Part #</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   - **Right Side Exterior**
   - **Left Side Exterior**
   - **Center Rearview**
   - **Front Entrance**
   - **Upper-Right Hand Corner**
   - **Rear Exit Area**
   - **Bicycle Rack**

BB. **SEATS**

1. **Manufacturer**

2. **Model #**

3. **Type**

4. **Material (Seat)**

5. **Material Inserts (Fabric)**

6. **Material Inserts (Cosmetic Plastic)**

CC. **PAINT**

1. **Manufacturer**
2. Type Paint
   _________________________________

3. Paint Program
   (If Available from Manufacturer):
   _________________________________

4. Manufacturer Formula Number
   _________________________________

DD. WHEELCHAIR RAMP EQUIPMENT
1. Manufacturer & Model No.
   _________________________________

2. Type
   _________________________________

3. Capacity
   _____________ Lbs.

4. Dimensions
   a. Width of Platform
      ____________ In.
   b. Length of Platform
      ____________ In.

5. System Fluid Capacity
   _____________ Qts.

6. Type Fluid Used
   _________________________________

7. Operating Hydraulic Pressure
   _________________________________

8. Hydraulic Cylinders
   _____________ psi
   a. Size
      _________________________________
   b. Number
      _________________________________

EE. WHEELCHAIR SECUREMENT EQUIPMENT
1. Manufacturer & Model No.
   _________________________________

2. Securement System
   _________________________________
   a. Retractors
   b. Floor Securement

FF. DESTINATION SIGNS
1. Manufacturer
   _________________________________

2. Type
   _________________________________

3. Character Length
   Front Destination
   ____________ In.
   Front Run Number
   ____________ In.
   Side Destination
   ____________ In.
Southeastern Pennsylvania Transportation Authority

Rear Route Number  _____________ In.

4. Character Height
   Front Destination  _____________ In.
   Front Run Number  _____________ In.
   Side Destination  _____________ In.
   Rear Route  _____________ In.

5. Number of Characters
   Front Destination  _____________ In.
   Front Run Number  _____________ In.
   Side Destination  _____________ In.
   Rear Route  _____________ In.

6. Message Width
   Front Destination  _____________ In.
   Front Run Number  _____________ In.
   Side Destination  _____________ In.
   Rear Route  _____________ In.

GG. ELECTRICAL
1. Multiplex System
   a. Manufacturer  ________________________

   b. Model No.  ________________________

   c. List ALL module types
      _______________________________________
      _______________________________________
      _______________________________________
      _______________________________________
      _______________________________________
Southeastern Pennsylvania Transportation Authority

2. Batteries (Low Voltage)
   a. Manufacturer ________________________
   b. Model No. ________________________
   c. Type ________________________
   d. Number of Batteries ________________________

HH. COMMUNICATION SYSTEM

1. P.A. System

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Amplifier</td>
<td>__________</td>
</tr>
<tr>
<td>b. Microphone</td>
<td>__________</td>
</tr>
<tr>
<td>c. Int. Speakers</td>
<td>__________</td>
</tr>
<tr>
<td>d. Ext. Speaker</td>
<td>__________</td>
</tr>
</tbody>
</table>

2. Automated Stop Annunciator System

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Software</td>
<td>Open Architecture _____ Yes/No</td>
</tr>
</tbody>
</table>

| System Components Operator Interface | |
|--------------------------------------|
| Announcement Controller | |
| Vehicle System Interface | |
| Data Interface | |
| Binary Interface | |
| Destination Sign Control | |
| Other | |

| AVM System | |
| System Components | |
| Data Storage Device | |
| Data Retrieval Type | |
Memory capacity

GPS System Supplier
GPS Receiver Manufacturer ___________________________ Model ____________
GPS Antenna Manufacturer ___________________________ Model ____________

3) Dead Recognizing System Concept

II. ENERGY STORAGE SYSTEM (Hybrid Configuration)

1. Batteries- Low Voltage
   a. Manufacturer
      __________________________
   b. Model No.
      __________________________
   c. Type
      __________________________

2. Batteries/Energy Storage System – High Voltage
   a. Manufacturer
      __________________________
   b. Model No
      __________________________
   c. Cold Current Amps
      __________________________
   d. Energy Density
      __________________________
   e. Specific Power
      __________________________
   f. Operating Temperature
      __________________________
   g. Storage System Ratings per Battery/Module
      __________________________
   h. Cooling System
      i. Active/Passive
         __________________________
      ii. Maximum Battery/Module Temperature
          __________________________
      iii. Maximum Temperature Range Across all Batteries/Modules
          __________________________
   i. Rating System
      i. Energy Efficiency
         __________________________
      ii. Estimated Calendar Life
          __________________________
      iii. Cycle Life
          __________________________
      iv. Voltage Each Cell
          __________________________
      v. SOC Operating Range
         __________________________
v. 2) Expected nominal fuel efficiency @ SOC ________________

3. External Battery/Module Conditioning __________________________

4. Battery/Module/System Equalization System
   a. Manufacturer ____________________________________________
   b. Model No. ______________________________________________

5. Ultra-Capacitors/Module
   a. Capacitor Manufacturer __________________________________
   b. Model Number __________________________________________
   c. Ratings
      i. Energy Efficiency _______________________________________
      ii. Estimated Calendar Life _________________________________
      iii. Cycle Life ___________________________________________
      iv. Voltage Each Cell _________________________________ Volts
      v. Voltage Module _________________________________________ Volts
   vi. Power
      1. Working _____________________ KW
      2. Peak _________________________ KW
   vii. Weight
      1. Per Each Module _________________________ pds
         2. Total Weight ______________________  pds

JJ. FIRE WARNING/SUPPRESSION SYSTEM
   Suppression
   a. Manufacturer __________________________________________
   b. Model _________________________________________________
   c. Type Sensor Nozzle ______________________________________
   d. Suppression Material _____________________________________
      Bottle Size
      Weight
      Discharge time
   e. Annunciator Location _____________________________________
Southeastern Pennsylvania Transportation Authority

Fire Warning
a. Manufacturer ___________________________

b. Model ___________________________

c. Type ___________________________

d. Location ___________________________

KK. Provide a Data Matrix of ESS Management vs. Fuel Management showing maximum Fuel Efficiency and ESS Life (Ref. TS 5.6).

LL. Provide information addressing respect for the environment. Proposer to submit list of certified contractors for recycling components. Proposer to submit recycling factors and cost estimates for ESS components (Ref. TS 5.26).

MM. Passenger Seating Layout Drawing per Specification Requirements (Ref. TS 9.5.1.1).

NN. Independent third party certification by a recognized engineering firm to certify that roof load bearing, crash test, exterior body panel criteria and meeting FMVSS requirements have been met for the bus proposed shall be submitted. Test certifications will include structural diagrams of the bus tested. These diagrams must match exactly, the bus proposed by the Contractor. (See Section TS 9.1.2 -- Crashworthiness).

OO. A detailed description of the tow devices for the bus proposal, including method of attaching the tow bar and light connector, shall be submitted. (See Section TS 9.2.2 -- Towing). A detailed description or elevation drawing/sketch of installed bumpers, front & rear, shall be provided. The drawing/sketch shall include the respective components showing clearance dimensions from the ground to bottom and tops of the bumper(s). The front bumper shall show the air and electrical connectors for towing. The clearance dimensions shall show an empty and normally loaded bus, i.e. SWL.

PP. A detailed description of the type of Fire Sensing and Suppression (FSS) equipment being furnished with the bus proposal, along with operational information and installation locations, shall be submitted. (See Section TS 10.9 -- Fire Suppression System).

QQ. Proposer shall supply dimensional drawings at the rear of the bus exterior illustrating maximum advertising space (Ref. TS 9.9.2.2).

RR. Proposers shall submit a complete list and description of Training Aids to be used for SEPTA Training. The list shall be submitted with attachment Number 1 – Vendors Equipment Specification.
APPENDIX 2

PRICE PROPOSAL
## APPENDIX 2 - PRICE PROPOSAL

Forty-Foot (40') Low-Floor Transit Buses per SEPTA Specifications
Price Diesel-Electric Hybrid Configuration Fully, Using Stated Quantity and Unit of Measure

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Qty</th>
<th>Unit of Measure</th>
<th>40-Foot Hybrid Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low-Floor Bus in accordance with Specification &amp; Schedules:</td>
<td>525</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Option Buses in accordance with Specifications &amp; Schedules:</td>
<td>25</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hybrid Propulsion System</td>
<td>525</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Option Buses Hybrid Propulsion System</td>
<td>25</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Capital Spare Parts - from Attachment A</td>
<td>N/A</td>
<td>Lump Sum</td>
<td>N/A</td>
</tr>
<tr>
<td>6</td>
<td>Training Aids - from Attachment B:</td>
<td>N/A</td>
<td>Lump Sum</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>Special Tools &amp; Equipment per Specifications - from Attachment C:</td>
<td>N/A</td>
<td>Lump Sum</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>Publication and Training per Specifications - Sections 6, TS12:</td>
<td>N/A</td>
<td>Lump Sum</td>
<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>On-Board Video Surveillance System: MobileView Penta MV5</td>
<td>525</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Option Buses On-Board Video Surveillance System: MobileView Penta MV5</td>
<td>25</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>MobileView Penta MV5 - Necessary infrastructure for system integration.</td>
<td>N/A</td>
<td>Lump Sum</td>
<td>N/A</td>
</tr>
<tr>
<td>12</td>
<td>Intelligent Vehicle Systems (IVS) - Necessary infrastructure for AVM system integration including user interface software</td>
<td>N/A</td>
<td>Lump Sum</td>
<td>N/A</td>
</tr>
<tr>
<td>13</td>
<td>Infotainment System: Section 6, TS 9.9.2.1.1</td>
<td>525</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Option Buses Infotainment System: Section 6, TS 9.9.2.1.1</td>
<td>25</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Passenger Seating: Stainless Steel Frame with Fabric Inserts</td>
<td>525</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Option Buses Passenger Seating: Stainless Steel Frame with Fabric Inserts</td>
<td>25</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Passenger Seating: Stainless Steel Frame with Cosmetic Plastic Inserts</td>
<td>525</td>
<td>Bus</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Option Buses Passenger Seating: Stainless Steel Frame with Cosmetic Plastic Inserts</td>
<td>25</td>
<td>Bus</td>
<td></td>
</tr>
</tbody>
</table>

Total Amount for Items 1 through 16 (Seats with Fabric Insert Option): $ 
Total Amount for Items 1 through 14, & 17 through 18 (Seats with Plastic Insert Option): $ 

Note: The 3rd, 4th, and 5th year buses (guarantee or option buses) are subject to the price adjustment provision in Section 3 - GC28.

Name of Proposer: ___________________________

PP - 2 Hybrid Bus
APPENDIX 2 - PRICE PROPOSAL
Forty-Foot (40') Low-Floor Diesel-Electric Hybrid Buses per SEPTA Specifications

General Notes:

The 3rd, 4th, and 5th year buses are subject to the price adjustment provision in Section 3 – Contract and General Conditions, GC27 – Price Adjustment for 3rd, 4th, and 5th Year of Order.

If offering more than one Hybrid Bus Powertrain System, then the Proposer must submit separate, fully completed Appendix 2 – Price Proposals for each of the Hybrid Bus Powertrain Systems being offered. Note that each Price Proposal must be identified by Hybrid Powertrain System.

Name of Firm: ________________________________________

Name of Hybrid System: ________________________________________

Signature: ________________________________________

Title: ________________________________________

Date: ________________________________________
APPENDIX 2: DELIVERY SCHEDULE

Delivery of the buses to be in accordance with the following Project Schedules:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delivery of 1st Pilot (40 ft.) Diesel-Electric Hybrid Bus</td>
<td>120 days prior to start of CY 2016 deliveries of 40 ft. Low Floor Diesel-Electric Hybrid Bus.</td>
</tr>
<tr>
<td>2</td>
<td>Delivery of 1st group 89 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2016</td>
<td>Between 300 Days Minimum and 480 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>3</td>
<td>Delivery of 2nd group 105 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2017</td>
<td>Between 600 Days Minimum and 780 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>4</td>
<td>Delivery of 3rd group 100 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2018</td>
<td>Between 960 Days Minimum and 1,160 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>5</td>
<td>Delivery of 4th group 115 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2019</td>
<td>Between 1,260 Days Minimum and 1,460 Days Maximum after Notice to Proceed Date.</td>
</tr>
<tr>
<td>6</td>
<td>Delivery of 5th group 115 (40 ft.) Diesel-Electric Hybrid Production Buses guaranteed for CY 2020</td>
<td>Between 1,620 Days Minimum and 1,820 Days Maximum after Notice to Proceed Date.</td>
</tr>
</tbody>
</table>

*Example: If Notice to Proceed (GC 2.7) is given to a contractor on October 1, 2015, production buses for calendar year 2016 would have to completely delivered to SEPTA between 7/27/2016 and 1/23/2017 in order to avoid Liquidated Damages in accordance with GC 7.3.

Note 1 – For any yearly option order, the Contractor will be notified in writing 190 days prior to the respective scheduled delivery period. The written notification will be for:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Delivery of Capital Spares to be in accordance with Attachment A.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Delivery of Training Aids to be in accordance with Attachment B.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Special Tools and Equipment per Specification per Attachment C.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Delivery of Publications and Training to be in accordance with Section TS 12 of Specification.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Delivery of Special Tools and Equipment to be within 60 days from delivery of 1st production bus.</td>
<td></td>
</tr>
</tbody>
</table>
## ATTACHMENT A: CAPITAL SPARES FOR 40-FOOT LOW-FLOOR DIESEL-ELECTRIC HYBRID BUS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Qty</th>
<th>Unit Price</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Complete Electrical Control and Distribution Assembly</strong> - An assembly includes one complete set of control module(s), multiplex system controller modules; LVDC Converter(s), High Voltage Junction Boxes, Medium Voltage Inverters, controllers and autonomous glycol cooling units (See Note A)</td>
<td>10</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>2</td>
<td><strong>Complete Front Door</strong>&lt;br&gt; An assembly includes front door leafs with door brushes, seal flaps, lower castings or sensitive edges and ready for installation upon removal from the shipping packing. (See Note A)</td>
<td>10</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>3</td>
<td><strong>Complete Rear Door</strong>&lt;br&gt; An assembly includes rear door leafs with door brushes, seal flaps, lower castings or sensitive edges and ready for installation upon removal from the shipping packing. (See Note A)</td>
<td>10</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>4</td>
<td><strong>Complete Engine Assembly (including ECM/EDU)</strong>&lt;br&gt; An assembly includes the engine and all components necessary for a complete quick engine changeout including alternators, accessories. (See Note C)</td>
<td>25</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>5</td>
<td><strong>Exhaust Aftertreatment (DPF/SCR/OC)</strong>&lt;br&gt; Assembly. Including dosers, doser control units, sensors and harnesses (See Note D)</td>
<td>25</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>6</td>
<td><strong>Complete Propulsion System for Hybrid Bus</strong>&lt;br&gt; Includes traction motor drive system with all gear reduction systems, traction inverter unit(s), generator(s), traction motor (s), drive units and shafts, all electrical and electronic controls including system controllers, necessary for a complete system (except for battery packs). (See Note C)</td>
<td>10</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>7</td>
<td><strong>Complete Wheel Chair Ramp Assembly.</strong> (See Note A)</td>
<td>10</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>8</td>
<td><strong>Complete Air Conditioning</strong>&lt;br&gt; An assembly includes the electronic control system; evaporator and condenser units, blower motors for the respective aforementioned units, sensing transducers, switches, valves for a bus mounted unit. . (See Note A, G)</td>
<td>10</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>9</td>
<td><strong>Complete HVAC Fan Motors</strong>, complete bus sets. (See Note B)</td>
<td>15</td>
<td>$___________</td>
<td>$___________</td>
</tr>
</tbody>
</table>
| Item | Description | Quantity | Price
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Test and Maintenance Equipment</td>
<td>10</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>11</td>
<td>Complete Set of Batteries for Hybrid bus Propulsion System</td>
<td>15</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>12</td>
<td>Complete Front Axle Assembly: An assembly includes all components necessary to change-out the entire front axle</td>
<td>10</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>13</td>
<td>Complete Rear Axle Assembly</td>
<td>10</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>14</td>
<td>Complete Rear Axle (Differential Only)</td>
<td>10</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>15</td>
<td>Electric Air Compressor Module (Built to Spec, Unit Complete with Contactor)</td>
<td>20</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>16</td>
<td>Complete Steering Box Assembly</td>
<td>25</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>17</td>
<td>Windshield Defroster Assembly Motor(s) Heater Unit</td>
<td>25</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>18</td>
<td>Complete Hydraulic System, i.e., pump(s), pressure control valve(s)</td>
<td>20</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>19</td>
<td>Complete Pneumatic Supply System Assembly including compressor/dryer</td>
<td>20</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>20</td>
<td>Complete Driver’s Seat Assembly</td>
<td>15</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>21</td>
<td>Passenger windows</td>
<td>10</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>22</td>
<td>Destination Sign, GPS &amp; ASAS Systems</td>
<td>5</td>
<td>$___________ $___________</td>
</tr>
<tr>
<td>23</td>
<td>Complete Set - Left and Right Windshield</td>
<td>25</td>
<td>$___________ $___________</td>
</tr>
</tbody>
</table>
### Destination Sign, GPS/ASAS Test and Maintenance Equipment
The test and maintenance equipment includes all necessary test equipment to monitor, troubleshoot and modify on-board system software and repair of the bus systems; equipment to store and create voice announcements and location identifiers, programming and monitoring of announcements and the duplication of media and equipment software and AVM up/down load software (2 sets). (See Note E)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>$__________</td>
</tr>
</tbody>
</table>

### Left and right, Front and Rear ea., wheel end assemblies
complete with spindle, hub, and brake set. (See Note D)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>$__________</td>
</tr>
</tbody>
</table>

### Complete Radiator/CAC Assembly
with electric cooling fans/motor modules and harnesses. (See Note D).

<table>
<thead>
<tr>
<th>Item</th>
<th>Price (15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>$__________</td>
</tr>
</tbody>
</table>

### Complete Engine Block and / or Supplement (Auxiliary) Heat Unit Assembly
(an assembly is a complete unit and the marine type circulating pump) (See Note D).

<table>
<thead>
<tr>
<th>Item</th>
<th>Price (15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>$__________</td>
</tr>
</tbody>
</table>

### Complete Fuel Tank Assembly
including pickup. (See Note E).

<table>
<thead>
<tr>
<th>Item</th>
<th>Price (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>$__________</td>
</tr>
</tbody>
</table>

### Video Surveillance/Wayside Equipment
including DVR, GE/Airspan ProST, Hard Drive Caddy, Antennas, and any vehicle interface devices if applicable.

<table>
<thead>
<tr>
<th>Item</th>
<th>Price (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>$__________</td>
</tr>
</tbody>
</table>

### LVDC Battery Pack Module
Complete as delivered. (Note B)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price (20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>$__________</td>
</tr>
</tbody>
</table>

**TOTAL AMOUNT FOR ITEMS 1 THROUGH 30 - 40-FOOT HYBRID BUS EQUIPMENT**

$________________

Include on Line 5 of Price Proposal
ATTACHMENT A: CAPITAL SPARES NOTES

Capital Spares

All Capital spares shall be delivered to SEPTA in accordance with the delivery schedule listed below. The Contractor shall develop a list of all Capital Spares that includes all sub-components within assemblies. The Capital spare list shall include all components quoted by the Contractor per Attachment A. This list shall have all sub-component part numbers and quantities included. This list shall also correlate SEPTA’s part number, and include delivery dimensions & weight. The Contractor shall provide the Capital spare list to the Project Manager no less than 60 days prior to estimated delivery of spares. The Contractor shall notify the Project Manager no less than 30 calendar days prior to delivery of Capital Spares. The Project Manager shall direct the Contractor to deliver specific components to various SEPTA locations and storage facilities. Just prior to shipment, the Contractor shall provide the Project Manager notification of shipment by electronically sending the packing list and associated shipment tracking information. All delivered Capital spares shall be conspicuously labeled with a contract reference number, SEPTA Part #, material description, quantity, count, purchase order number (P.O.#) and SEPTA fleet number. Subsequent to delivery, the Contractor shall supply the Project Manager with signed documentation of proof of delivery. Under no circumstances shall payment for any Capital Spares be processed without proof of delivery. Contract closure shall not be considered without receipt of all deliverables.

Capital Spares Delivery Schedule Notes

Note A: Quantity one (1) during 2016 delivery schedule, balance in 2017 delivery schedule

Note B: Quantity 25% during 2016 delivery schedule, balance in 2017 delivery schedule

Note C: Quantity 20% during each year’s delivery schedule

Note D: Quantity 50% during 2016 and 2017 delivery schedules

Note E: Quantity 100% during 2016 delivery schedule

Note F: Quantity one (1) during 2016 delivery schedule, balance to be delivered upon written notice
# ATTACHMENT B: TRAINING AIDS & EQUIPMENT FOR 40-FOOT LOW-FLOOR DIESEL-ELECTRIC HYBRID BUS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit Price - Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Towing</strong></td>
<td>One towing fixture should be included for the Training Center for orientation and future demonstrative purposes.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Pneumatic System</strong></td>
<td>One complete pneumatic system simulator board. Board or “mock-up” should include all installed pneumatic components in their respective positions on the vehicle. All tanks, valves, relays and switches to be included and functional. Unit can be plumbed to accept “shop air” as the compressed air source to operate the components. Unit should comply with the vehicle system pneumatic schematic as applied to the vehicle.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Intelligent Vehicle System Simulator</strong></td>
<td>One complete “Bus in a Box” Solution with simulated operational data delivered 120 Days after Notice to Proceed. This complete simulator system would be designed for operational trainings and as an active desktop workstation for the SEPTA IVS Administration. Said simulator should also have the capability to be switched from simulated data to SEPTA real time operational data once vehicles begin to be delivered to SEPTA. The simulator shall provide complete functionality for the following IVS solutions: Automatic Vehicle Monitoring (AVM), Computer Aided Radio Dispatch (CARD), Automatic Vehicle Location (AVL), Automatic Stop Announcement System (ASAS), Analytics, and full reporting features. The hardware configuration will consist of complete desktop based PC with multiple monitors (minimum 3) for viewing multiple displays. In addition, a large monitor display (minimum 40” diagonally) will be integrated into the IVS simulator system for training demonstrations.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Intelligent Vehicle System</strong></td>
<td>Two complete physical layer system operating models for SEPTA's Electronics Shop. Unit to include all necessary items/components required to operate this unit in an electronic repair shop environment.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Anti-Lock Brake Simulator</strong></td>
<td>The Pneumatic and the Anti-lock Brake Simulator Training Aids may be combined into one (1) unit. The unit(s) may be manufactured by a third party. For the purposes of explaining and demonstrating this application on a pneumatic brake system, one anti-lock simulator of the exact system installed on the vehicle shall be included. System to illustrate and demonstrate the electrical/electronic portion of this system. Mock-up should be manufactured by the original ABS originator, such as Bendix, WABCO, or Rockwell.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Electrical System</strong></td>
<td>One simulator board for multiplex controlled electrical systems, complete with all modules, simulated input and output devices, supply voltage and all necessary items required to function this subassembly independently in a classroom environment.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Destination Sign Unit</strong></td>
<td>One destination sign simulator to include a power supply, front and side sign components and all other necessary items required to independently function this subsystem in a classroom environment.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>HVAC System</strong></td>
<td>Two complete fully operational and functioning HVAC training simulators mounted on a movable stand including electronic controller and diagnostic capabilities. Unit as built shall include all necessary medium voltage switch gear and interposing transformer.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Fire Suppression System</strong></td>
<td>One simulation board of this system and its components.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Wheelchair Ramp</strong></td>
<td>One complete independently operable wheelchair lift unit. Unit to include power supply and all other necessary items required to operate this unit in a classroom environment.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Propulsion System</strong></td>
<td>One complete fully functional training simulator of the complete propulsion system for Hybrid bus that describes the theory of operation, interconnections and functions of the system and system components. Said simulator shall be a PC animation based system that demonstrates all functional system elements.</td>
<td>$_______________</td>
</tr>
<tr>
<td><strong>Exit Door System</strong></td>
<td>One complete, functional passenger door system simulator. Mounted on movable stand. Shall include Class Detector System, Sensitive Edges and APC System. The simulator shall be a proportional scaled and weighted model permitting 70-90% by height males to view, control and diagnose the door engine operator and transmission at eye level. Logic and controls shall be exact in control and process.</td>
<td>$_______________</td>
</tr>
</tbody>
</table>

**TOTAL AMOUNT FOR TRAINING AID & EQUIPMENT 40-FOOT HYBRID:**

Include on Line 6 of Price Proposal
ATTACHMENT B: TRAINING AIDS & EQUIPMENT NOTE

Note: Approval and Delivery

The selected Contractor shall provide scaled drawings of all Training aids for SEPTA approval prior to construction. All Training aids shall be delivered to SEPTA 60 days prior to delivery of the first production coach. The contractor shall notify the Project Manager no less than 30-calendar day's prior scheduled delivery of Training aids. All delivered Training aids shall be conspicuously labeled with a contract reference number, material description, quantity, count, purchase order number (P.O. #) and SEPTA fleet number. Subsequent to delivery, the contractor shall supply the Project Manager with signed documentation of proof of delivery. Under no circumstances shall payment for any Training aid be processed without proof of delivery. Contract closure shall not be considered without receipt of all deliverables. All Training aids shall be delivered to SEPTA, STATS, 4675 North 3rd Street, Philadelphia PA 19140. Should the Contractor elect to offer SEPTA substitute material and / or equipment over the course of contract that makes the training aid or part thereof obsolete or ineffective as a correct training aid, the Contractor shall update the training at no cost to SEPTA.
### APPENDIX 2 - ATTACHMENT C
SPECIAL TOOLS AND EQUIPMENT—40 FOOT LOW FLOOR BUSES

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Qty.</th>
<th>Unit Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compartment access door keys (5/16” square key) (2 Per Bus)</td>
<td>1100</td>
<td>$__________</td>
<td>$__________</td>
</tr>
<tr>
<td>2</td>
<td>Radio Box Key (#CH751) (2 Per Bus)</td>
<td>1100</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Front destination sign compartment cover Key (Southco 29-90-215-10) (2 Per Bus)</td>
<td>1100</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Hoist Adapters</td>
<td>10</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Towing Bars/adapters</td>
<td>10</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Jacking adapters</td>
<td>10</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Break out boxes for Propulsion systems (all system elements, engine, inverters, converters, controllers)**</td>
<td>10</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Battery Pack removal Tool (Septa Spec)</td>
<td>12</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Propulsion system proprietary tools, includes all adaptors, break out and test fixtures, include all overhaul of drive unit, Battery pack, controllers**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Engine tune up kit including belt tension gauge, seal installers/removers, injector timing gauge, valve lash gauges, etc.**</td>
<td>5</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>407c Hermitic HVAC System tools, charging stations, (2 each refrigerant containers per station)</td>
<td>12</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Rear Differential proprietary Tools**</td>
<td>12</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Wheel end/hub service tools**</td>
<td>12</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Disc Brake proprietary Tools and gauges**</td>
<td>14</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Diagnostic readers for HVAC system**</td>
<td>30</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1st Year Laptop Computer Kits for troubleshooting of the multiplex system as specified in TS 11.4.1</td>
<td>29</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Camera Laptop as specified in TS 11.4.1</td>
<td>1</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>CAN Software Kits (Vector CAN 1939/1708) and connecting cabling. Installed for Engineering PC's (4 Kits in 1st Year, 4 Kits with Hardware/Software refresh in 4th Year of Contract).</td>
<td>8</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>4th Year Laptop Hardware/Software Refresh Kits as specified in TS 11.4.1</td>
<td>29</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Electric Cooling Fan control emulation, connection cabling, etc.**</td>
<td>9</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Battery High Voltage Tools Set</td>
<td>14</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Fuel Focus Test equipment (Maximus Model # KBX-MT-03-MAX) §TS 7.7.3.7</td>
<td>8</td>
<td>$__________</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Emissions, Unit/DPF/Reactor Tube/SCR or Unitized System Shipping Containers</td>
<td>60</td>
<td>$__________</td>
<td></td>
</tr>
</tbody>
</table>
### ATTACHMENT C: SPECIAL TOOLS & EQUIPMENT NOTE

Reference: RFP Section 6 – Specifications, sections TS 11.3 - TS 11.5

Maintenance and Inspection / Back Shop Support Equipment:

All Maintenance and Inspection/Back shop Support Equipment shall be delivered to SEPTA coincident to delivery of the first production coach. The Contractor shall provide the Project manager with a list that includes specifications for all diagnostic and Support equipment provided under this contract. All Special Tools & Equipment shall be delivered to SEPTA 60 days prior to Delivery of the First Production Coach. The Contractor shall notify the Project Manager in writing no less than 30 calendar days prior to delivery of maintenance and inspection equipment/Back Shop Support Equipment. The Project Manager shall direct the Contractor to deliver specific tools to various SEPTA locations. All delivered tools and equipment shall be conspicuously labeled with a contract reference number, material description, quantity, count purchase order number (P.O. #) and SEPTA fleet number. Subsequent to delivery the Contractor shall provide the Project manager with signed documentation of proof of delivery. Contract closure shall not be considered without receipt of all deliverables.

---

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Price 1</th>
<th>Price 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Tablet Computers &amp; Hotspots for Inspection Process (QA 1.2.2.1)</td>
<td>8</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>25</td>
<td>IVS Boundary scan tools for all system elements</td>
<td>6</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>26</td>
<td>Fluke 124/003s Meter kits</td>
<td>12</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>27</td>
<td>Graphtec GL900-8 data logger (include 1 ea B-517 Battery Pack, 4 ea B-514 DC cable)</td>
<td>2</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>28</td>
<td>Amprobe MO-100 Low Ohm Meter</td>
<td>2</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>29</td>
<td>Keysight Technologies U1253B VOM</td>
<td>6</td>
<td>$___________</td>
<td>$___________</td>
</tr>
<tr>
<td>30</td>
<td>Fluke 90i-610s 1A to 600A AC/DC Current Probe</td>
<td>8</td>
<td>$___________</td>
<td>$___________</td>
</tr>
</tbody>
</table>

**TOTAL AMOUNT FOR ITEMS 1 THROUGH 30 - BUS SPECIAL TOOLS & EQUIPMENT**

$___________

Include on Line 7 of Price Proposal
Price Proposal Acknowledgement for RFP 15-00086-AJKF

40-Foot Low-Floor Diesel-Electric Hybrid Buses

Name of Manufacturer: ___________________________________________________

Authorized Representative: ______________________________________________

Title: ___________________________________________________

Date: ___________________________________________________

Address: ___________________________________________________

___________________________________________________

___________________________________________________

Contact Information:

Phone (office): ___________________________________________________

Phone (mobile): ___________________________________________________

Email: ___________________________________________________
APPENDIX 3

PROJECT PROGRESS AND PERFORMANCE EVALUATION FORM
# PERFORMANCE EVALUATION

## CONSTRUCTION CONTRACTS

### PART I - GENERAL CONTRACT DATA

3. **CONTRACTOR (Name, address and ZIP code)**

4. **TYPE OF CONTRACT** *(Check)*
   - B. **NEGOTIATED** *(Check one)*
     - G. FIRM FIXED PRICE
     - G. COST PLUS FIXED FEE
     - G. OTHER *(Specify)*

5. **COMPLEXITY OF WORK**
   - G. DIFFICULT
   - G. ROUTINE

6. **DESCRIPTION AND LOCATION OF WORK**

7. **FISCAL DATA**
   - A. AMOUNT OF BASIC CONTRACT
   - B. TOTAL MODIFICATION AMOUNT OF
   - C. LIQUIDATED DAMAGES ASSESSED
   - D. NET AMOUNT PAID CONTRACTOR

8. **SIGNIFICANT DATES**
   - A. DATE OF NOTICE TO PROCEED
   - B. ORIGINAL CONTRACT COMPLETION DATE
   - C. REVISED CONTRACT COMPLETION DATE
   - D. DATE WORK ACCEPTED
   - D. DATE OF FINAL PAYMENT

9. **TYPE AND EXTENT OF SUBCONTRACTING**

### PART II - PERFORMANCE EVALUATION OF CONTRACTOR **(Check appropriate box)*

10. **PERFORMANCE ELEMENTS**
    - OUTSTANDING
    - SATISFACTORY
    - UNSATISFACTORY
    - *(Explain in Item 14, on reverse)*

   A. QUALITY OF WORK
   B. TIMELY PERFORMANCE
   C. EFFECTIVENESS OF MANAGEMENT
   D. COMPLIANCE WITH LABOR STANDARDS
   E. COMPLIANCE WITH SAFETY STANDARDS

11. **OVERALL EVALUATION**
    - ○ OUTSTANDING *(Explain in Item 14, on reverse)*
    - ○ SATISFACTORY
    - ○ UNSATISFACTORY *(Explain in Item 15, on reverse)*

12. **EVALUATED BY**
    - A. ORGANIZATION
    - B. NAME AND TITLE
    - C. SIGNATURE
    - D. DATE

13. **EVALUATION REVIEWED BY**
    - A. ORGANIZATION
    - B. NAME AND TITLE
    - C. SIGNATURE
    - D. DATE
14. REMARKS ON OUTSTANDING PERFORMANCE AS INDICATED BY THE CONTRACTOR'S PERFORMANCE ON THIS CONTRACT. IF YOU CONSIDER THE CONTRACTOR OUTSTANDING, SET FORTH FACTUAL DATA SUPPORTING THIS OBSERVATION. THESE DATA MUST BE IN SUFFICIENT DETAIL TO ASSIST SEPTA IN SELECTING CONTRACTORS THAT HAVE DEMONSTRATED OUTSTANDING QUALITY OF WORK AND RELIABILITY. (Continue on separate sheet if needed)
15. EXPLANATION OF UNSATISFACTORY EVALUATION. FOR EACH UNSATISFACTORY ELEMENT, PROVIDE FACTS CONCERNING SPECIFIC EVENTS OR ACTIONS TO JUSTIFY THE EVALUATION (e.g., extent of SEPTA inspection required, rework required, subcontracting, cooperation of contractor, quality of workmen and availability of equipment). THIS DATA MUST BE IN SUFFICIENT DETAIL TO ASSIST SEPTA IN SELECTING CONTRACTORS RESPONSIBILITY. (Continue on separate sheet if needed)
APPENDIX 4

SEPTA PROTEST PROCEDURES
SEPTA Bid/Proposal Protest Procedure: Bid/proposal protests relative to this procurement will be reviewed and adjudicated by SEPTA in accordance with the attached Bid/Proposal Protest Procedure.

SEPTA BID/PROPOSAL PROTEST PROCEDURE

1.0 PURPOSE

1.1 This section describes the policies and procedures governing the receipt and resolution of protests in connection with an Invitation for Bid (IFB) or Request for Proposal (RFP). This procedure is applicable to all procurements in excess of $100,000. Bid/proposal protests for procurements of less than $100,000 shall be informally handled by the Senior Director of Procurement or his/her designee.

2.0 DEFINITIONS

2.1 "Interested Party" means any bidders/proposers.
2.2 "days" means business days.
2.3 “Filed” means the date of receipt by The Office of SEPTA’s Senior Director of Procurement or his/her designee (hereinafter Senior Director of Procurement).
2.4 “Federal/State Law or Regulation” means any valid requirement imposed by Federal, state, or other Statute or regulation.
2.5 “Presumptive Contractor” means the bidder/proposer that is in line for award of the contract in the event that the protest is denied.
2.6 “Protestant” is an Interested Party who is aggrieved in connection with the solicitation or award of a contract and who files a protest.

3.0 TYPES OF PROTESTS/ TIME LIMITS

3.1 Pre-Bid/Proposal Protest is based upon alleged restrictive specifications or alleged improprieties in SEPTA’s procurement process. A Protestant must file a pre-bid/proposal protest no later than five (5) days prior to bid opening date by 4:30 p.m. Philadelphia prevailing time.

3.2 Pre-Award Protest is based upon alleged improprieties of a Bid/Proposal. A Protestant must file a pre-award protest no later than five (5) days after the Protestant knows or should have known of the facts giving rise thereto by 4:30 p.m. Philadelphia prevailing time.

3.3 Post-Award Protest is based upon the award of a contract. A Protestant must file a post-award protest no later than five (5) days after the notification to the unsuccessful firms of SEPTA’s intent to award, or no later than five (5) days after an unsuccessful firm becomes aware of SEPTA’s intent to award a contract, whichever comes first, by 4:30 p.m. Philadelphia prevailing time.

4.0 CONTENTS OF PROTEST

4.1 Protests must be in writing, and filed directly with the Office of SEPTA’s Senior Director of Procurement, at the address indicated in the solicitation, and must contain the following information:

1. The name, address and telephone number of the Protestant; and
2. Identity of the IFB or RFP (by number and description); and
3. A detailed factual statement of the grounds for protest; and
4. The desired relief, action or ruling.

5.0 ACTION BY SEPTA

5.1 Procurement Process Status

Upon timely receipt of a protest, SEPTA will delay the opening of bids until after resolution of the protest for protests filed prior to the bid opening, or withhold award until after resolution of the protest for protests filed after bid opening. However, SEPTA may open bids or award a contract whenever SEPTA, at its sole discretion, determines that:

a. The items or work to be procured are urgently required; or
b. Delivery or performance will be unduly delayed by failure to make the award promptly; or

If the protest is filed before the award of the contract, SEPTA will advise the Presumptive Contractor of the pending protest.

5.2 If deemed appropriate, SEPTA may conduct an informal conference on the merits of the protest with all Interested Parties invited to attend.

5.3 Response to the Protest

SEPTA’s Senior Director of Procurement will respond in detail to each substantive issue raised in the protest within a reasonable time after the protest is filed. SEPTA’s response shall address only the issues raised originally by the Protestant.

When, on its face a protest does not state a valid basis for protest or is untimely, the Senior Director of Procurement may summarily dismiss the protest without requiring a detailed response.

5.4 Rebuttal to SEPTA Response

The Protestant may submit a written rebuttal to SEPTA’s response, addressed to the Senior Director of Procurement, but must do so within five (5) days after receipt of the original SEPTA response. SEPTA will not address new issues raised in the rebuttal. After receipt of the Protestant’s rebuttal, the Senior Director of Procurement will review the protest and notify the Protestant of his/her final decision.

5.5 Request for Additional Information

Failure of the Protestant to comply with a request for information as specified by SEPTA’s Senior Director of Procurement, may result in determination of the protest without consideration of the additional information if subsequently produced. If any Interested Party requests information from another Interested Party, the request shall be made to SEPTA’s Senior Director of Procurement, and, if SEPTA so directs, shall be complied with by the other party within five (5) days.
Southeastern Pennsylvania Transportation Authority

5.6 Request for Reconsideration

If data becomes available that were not previously known, or there has been an error of law, a Protestant may submit a request for reconsideration of the protest. SEPTA’s Senior Director of Procurement will again review the protest considering all currently available information. The Senior Director of Procurement’s determination will be made within a reasonable period of time, and his/her decision will be considered final.

5.7 Decision

Upon review and consideration of all relevant information the determination as issued by SEPTA will be final.

6.0 CONFIDENTIALITY OF PROTEST

Material submitted by a Protestant will not be withheld from any Interested Party, except to the extent that the withholding of information is permitted or required by law or regulation. If the Protestant considers that the protest contains proprietary material which should be withheld, a statement advising of this fact must be affixed to the front page of the protest submission and the allegedly protected information must be so identified whenever it appears.

7.0 FEDERAL TRANSIT ADMINISTRATION (FTA) INVOLVEMENT

Where procurements are funded by the FTA, the Protestant may file a protest with the FTA only where the protest alleges that SEPTA failed to have or failed to adhere to its protest procedures. Any protest to the FTA must be filed in accordance with FTA Circular 4220.1F.
APPENDIX 5

FAREBOX INFORMATION
C.4.1 Position Farebox on the Bus

Study and determine the farebox location carefully. Figure C-3 shows the dimensions for clearances. Position the farebox on the bus to provide for the following:

- Inspection plate and display must face the driver.
- Driver pushbutton keypad is in easy reach of the driver.
- Money can be easily inserted by passengers.
- Adequate room is provided for the driver to get into and out of the driver’s seat and operate any nearby controls.
- Maximum clearance is provided for the aisle width so that wheelchairs (if lifts are provided on the bus) can clear the farebox.

- Drilling and bolt fastening do not interfere with any of the bus mainframe members or any of the air, electric, or hydraulic lines.

![Diagram of farebox dimensions](image)

**Figure C-3**

Farebox mounting clearance
C.4.2 Drilling the Mounting Holes

After the farebox is positioned, mark the four holes on the floor where the farebox mounting plate will be fastened. Check the position of the holes, using the farebox-mounting plate drawing (figure C-4.) After the final position is determined, prepare a template of thin-gauge aluminum sheet to ensure consistency in mounting.

NOTE: Once the holes are drilled into the floor, making alternate sets of “new” holes tends to weaken a wood floor. Make sure that the first set of holes is the final set.

1. Using a 1/2 inch drill bit and an electric drill, drill four (4) holes in the floor. Be careful to drill the holes straight. In most instances, the hole must also go through the rubber matting on the floor. Be careful, as the rubber may cause the drill bit to shift, changing the relationship of the holes.

2. After the bolt holes are drilled, drill two additional holes: one for the ground strap; and one for the power cord. These holes should be positioned in accordance with locations noted on the template.

Good practice suggests that a pilot hole (1/8") be drilled first, to confirm the hole locations and to guide the 1/2" drill bit through the hole. Do not use a larger drill bit, as the bolts must fit tightly.

Hole positions on farebox mounting plate

Figure C-4
C.4.3 Adjusting the Handrails and Stanchions

Buses have various types of handrails and poles (stanchions) that are fastened to the floor or front bulkhead. These help passengers board the bus and protect them, when standing, from being thrown against the farebox in the event of a sudden stop.

Depending on the bus manufacturer and the year the bus was built, the railings may be simple or complex in assembly and fastening. In many instances, they will have to be modified to suit the clearances required for the farebox.

The farebox clearances provide for the following:

- installation of the farebox in the desired position
- the rear maintenance door to be fully opened and allow adequate space to remove components
- the top cover to fully open and allow adequate space to remove components
- the cashbox access door (on the lower portion of the farebox) to open, allowing adequate space to remove and insert the cashbox.
Southeastern Pennsylvania Transportation Authority

Mounting GFI Farebox for Quick Disconnect

<table>
<thead>
<tr>
<th>Line</th>
<th>Item Part#</th>
<th>Description</th>
<th>Kit</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C07518-0001</td>
<td>Mounting Plate (Stainless Steel)</td>
<td>B</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>A07517-0001</td>
<td>* Base Stud 3/8 – 16 x 3&quot;</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>A03174-0001</td>
<td>Flat washer (3/8&quot;) 1-1/4 O.D</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>A00294-0008</td>
<td>3/8 Split Lock washer</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>A03173-0001</td>
<td>3/8-16 Hex Nut</td>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Black Rubber Base</td>
<td>A</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>A03161-0009</td>
<td>Security Bolt 3/8-16x1&quot; LG</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>A00380-0008</td>
<td>Flat washer (3/8&quot;) 13/16 O.D.</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>B03165-0001</td>
<td>Lock Bolt Assembly (Barrel Lock assy)</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>B11275-000X</td>
<td>Key, Medeco MR-1XX</td>
<td>A</td>
<td>2</td>
</tr>
</tbody>
</table>

*Length may vary depending on Vehicle Pedestal

* Kit “A” above will be purchased and installed by SEPTA upon delivery of vehicles to Philadelphia. The manufacturer shall procure and install Kit “B” above during the production of SEPTA vehicles.

Initial Issue
WIRE CONNECTION:
A — CLEAR/WHITE (+12VDC)
B — BLACK (Ground)
C — SHIELD
D — NC

CABLE: Belden Type 8720 (2 conductor shielded)
CONNECTOR: ITT Cannon #192926-0500 (4-Contact Ringlock Connector)
CABLE CLAMP: ITT Cannon #192990-1530
SOCKET: ITT Cannon #192990-1230

Notes:
1. All crimps to be made with the manufacturer's approved crimping tool.
2. All wire stripping shall be done with heat strippers or in such a way so as not to break any strands from the stranded conductors.
3. One pre-production sample to be supplied to Revenue Operations Engineering Section.
   Attn: N. Chacko, for evaluation and approval.

SCALE: NONE
DRAWN BY: N. Chacko
DATE: 12-16-03

TITLE: FAREBOX POWER CABLE ASSEMBLY
       15' Long

WORK ORDER NO.
DRAWING NO. A 121603
APPENDIX 6

SEPTA INTERIOR & EXTERIOR BUS GRAPHICS
Southeastern Pennsylvania Transportation Authority

The decal design includes a blend from red to blue in the proportions shown in the attached sketch. Samples of exact red and blue colors to be matched will be provided by SEPTA to the successful vendor.

Transitions from the red through the blend to the blue must be smooth and without banding or visual separation.

A pre-production proof/prototype digitally printed on 3M controltac or equivalent materials approved per samples supplied (not a color computer plot simulation) must be provided for SEPTA's approval of: A) color matches for the red and blue samples provided; B) location and proportions of the blend; and C) smoothness of the resulting blend.

The decals are to be digitally printed and made from 3M 160-10C Controllac. The colors are to be printed with 3M 9800 UV resistant inks, then clear coated with 3M 9720. The reflective decals are to be made from 3M 600-10CR Reflection Film. No substitutes.

This exterior with logo and related typography will be made available to the selected provider in Macromedia format. Exact sizing and proportioning techniques to be determined and approved by SEPTA. For any graphic questions call SEPTA Graphics Services, 215-580-0000 or 215-580-REPORT.
Southeastern Pennsylvania Transportation Authority

Interior Bus Decal List

- 5000
  - 1. Interior vehicle ID numbers 2" h helvetica Bold
  - 2. yellow line decal 15" x 1.5"

Please stand behind yellow line

WELCOME ABOARD

- 4. Welcome aboard decal 15" x 5"
- 5. Rules decal 15" x 5" 2 each

PLEASE

- 6. NO SMOKING
- 7. NO EATING
- 8. NO DRINKING

Thanks for Riding

- 8. Thanks decal 15" x 5” 1 each
- 9. EXIT decal A 15" x 1.5" 2 each
- 10. EXIT decal B 15" x 1.5" 2 each
- 11. EXIT decal C 15" x 2" 1 each
- 12. EXIT decal D 15" x 2" 2 each

Please EXIT By Rear Door

Schedules

- 13. Schedule box decal 4 each 3.25" x 2" clear decal
- 14. ADA checklist (Ramp or Lift) 1 each 5.75" x 8"
- 15. Pull cord decal 1.375" x 3.6" 12 each
- 16. Window exit 4" x 4" 4 each

Jack point decal 2" x 4"
Southeastern Pennsylvania Transportation Authority

PLEASE WATCH YOUR STEP

17. Watch step decal 17” x 2.5”
   3 each

THANX, YOU for Not Crowding the Front Aisle

18. Move back (large decal) 24” x 4.75”
   1 each

Our New Low Floor Buses Offer Premium Seating Uptstairs.
Please Follow the Arrows

19. Move back (door side) 11” x 3.75”
   1 each

Our New Low Floor Buses Offer Premium Seating Uptstairs.
Please Follow the Arrows

19B. Move back (driver side) 11” x 3.75”
   1 each

For Customer Service & Security Cameras may be In use on this vehicle

23. Security Camera 13” x 4.5”
    1 each

FIRE EXTINGUISHER

21. Fire Extinguisher decal 7” x 1”
    1 each

Driver Will Open Doors When Vehicle Stops

22. Back door decal 22” x 1.5”
    1 each