

# Exhibit A

DEC 07 2018  
10:59am

*[Signature]*  
CLERK DISTRICT COURT

STATE OF NEW MEXICO  
COUNTY OF BERNALILLO  
SECOND JUDICIAL DISTRICT COURT

Case No. D-202-CV-2018-

CITY OF ALBUQUERQUE,  
Plaintiff,

**CV** 2018 0 8 9 5 5  
SUMMONS (FS) ISSUED

v.

BYD MOTORS, INC.,  
Defendant.

**COMPLAINT FOR BREACH OF WARRANTIES,  
BREACH OF CONTRACT, FRAUDULENT MISREPRESENTATION, NEGLIGENT  
MISREPRESENTATION, AND VIOLATION OF  
UNFAIR PRACTICES ACT**

**Parties and Jurisdiction**

The Plaintiff, City of Albuquerque ("City"), by and through its attorney, Sanchez, Mowrer & Desiderio, P.C., and the City Attorney for the City of Albuquerque, files this Complaint for Breach of Warranties, Breach of Contract, Fraudulent Misrepresentation, Negligent Misrepresentation, and Violation of Unfair Practices Act against Defendant BYD Motors, Inc. ("BYD").

1. The City is an incorporated municipality within the County of Bernalillo, New Mexico.
2. Upon information and belief, BYD is a Wyoming corporation, whose principal place of business is in California.
3. BYD transacted business in New Mexico.
4. This Court has jurisdiction over BYD, to which BYD has consented.
5. The Court has jurisdiction over the parties.
6. Venue is proper in this Court.

*okay to file -  
[Signature]  
12.7.18*

**General Allegations**

7. The City and BYD entered in a contract on January 26, 2017, attached as **Exhibit A**.

8. The contract incorporated a Request for Proposals, Solution Number P2016000031, for 60-foot 5-Door Bus Rapid Transit (“BRT”) Buses (“RFP”), attached as **Exhibit B**; BYD’s proposal in response to the RFP (“Proposal”), **Exhibit C**; and BYD’s Best and Final Offer, **Exhibit D** (collectively, the “Contract”).

9. Under the Contract, BYD agreed to provide the City eighteen (18) 60-foot 5-door BRT buses for the Albuquerque Rapid Transit (“ART”) bus project, including manuals, training, certain other features and delivery charges for a total price of \$22,921,136.56.

10. BYD promised to deliver the buses beginning the week of June 26, 2017, with all the buses to be delivered no later than the week of October 2, 2017.

11. BYD represented and warranted that the buses would conform to the specifications and warranties stated in the RFP and Proposal.

12. BYD represented and warranted that the buses would be safe and free of corrosion and defects.

13. BYD represented and warranted that the batteries would meet or exceed the route model, including speed elevation and pull, as specified in the RFP.

14. BYD represented and warranted that the buses could be driven for 275 miles on a single battery charge.

15. BYD represented and warranted that the buses would be Altoona-tested, recognizing that passing the Altoona test is a Federal Transportation Administration requirement.

16. BYD represented and warranted that it would provide the City with the results of the Altoona testing prior to delivery of any buses.

17. BYD represented and warranted that it would provide the City with certifications that the buses met federal standards, the RFP specifications and the RFP and Proposal warranties, including a signed crash-worthy certificate, for each and every bus delivered to the City.

18. BYD delivered fifteen (15) buses to the City.

19. There were substantial delays with respect to the delivery of those buses; all the buses were not delivered to the City by the week of October 2, 2017.

20. Upon inspection, the City discovered that the buses, individually and collectively as a fleet, were not free of defects, including, but not limited to, cracks in their frames and bodies; welds as to frames that were improper or incomplete; frames were rusting; clamps, wiring and hoses were improperly installed; wires and cables were exposed.

21. Upon inspection, the City discovered that the buses were not safe, including, but not limited to, the brakes not functioning properly; the rear doors opening while the buses were in motion; the placement of the exit door was such that passengers would not be able to exit the buses in an emergency; the batteries could catch on fire with little possibility of putting out the fire; the high voltage wiring was exposed and not properly highlighted; security for wheelchairs did not properly secure wheelchairs; and the bridge plates did not function properly.

22. As a result of those safety issues, the City determined that if the City placed the buses in operation it would expose drivers and passengers to serious risks of injuries, including fatalities.

23. Upon inspection, the City discovered that the average miles per charge that buses could be driven was substantially lower than the 275 miles represented by BYD.

24. Upon information and belief, the BYD buses have not passed the Altoona testing.

25. Upon information and belief, the buses cannot meet the speed elevation and pull specified in the RFP.



26. BYD did not provide the City with signed certificates of crash-worthiness for any of the buses.

27. The buses did not conform to BYD's affirmations, descriptions, representations and promises, and cannot be repaired.

28. The nonconformity of the buses individually and as a fleet, substantially impaired the value of all the buses to the City.

29. BYD knew and understood that the City contracted to purchase the fleet of buses to operate the ART program. The City was not able to do so with the buses delivered to it.

30. BYD intentionally, carelessly and recklessly delivered buses that it knew, or should have known, were not as it represented, were in violation of federal requirements and industry standards, and were dangerous if they were operated.

31. The City, on numerous occasions, within a reasonable period of time after delivery of buses, informed BYD that it had rejected all the buses.

32. The City reasonably assumed and relied on BYD's assurances that BYD would cure any nonconformities. BYD did not do so.

33. The defects in the buses cannot be cured.

34. On November 13, 2018, the City gave BYD formal notice that it was rejecting the buses, or, to the extent it had accepted any buses, that it was revoking its acceptance of those buses and that it would seek damages for losses suffered by the City.

35. On November 28, 2018, in response to the City's notice that it was rejecting or revoking acceptance of the buses, BYD removed and took possession of all 15 buses.

36. The City no longer has the buses.

37. The City has reasonably, and in good faith, covered by purchasing ten (10) substitute buses at a price of \$9,063,142.51.

38. At this time, the City is not able to acquire the additional 8 buses.

39. The City has incurred reasonable incidental damages in the inspection, care and custody effecting cover and delay.

40. The City has suffered consequential damages resulting from BYD's delivery of nonconforming goods, breach of contract, or misrepresentations, about which BYD at the time of contracting, had reason to know and which could reasonably have been prevented.

**Count I**  
**Breach of Express Warranty**

41. The City incorporates ¶¶ 1-40.

42. BYD affirmed, promised and represented that the buses were free of defects and safe.

43. BYD affirmed, described, promised and represented that the buses met all the RFP specifications and warranties under the RFP and the Proposal.

44. BYD affirmed, promised and represented that it would have the buses Altoona-tested and would provide the City with a copy of the results of that test before delivery of any buses.

45. BYD affirmed, promised and represented that it would provide the City with certifications required by federal transportation law and rules, the RFP and the Proposal, including signed certifications that each bus was crash-worthy.

46. BYD affirmed, described, promised and represented that the buses could be driven 275 miles on a single battery charge.

47. BYD affirmed, promised and represented that it would deliver all the buses no later than the week of October 2, 2017.

48. Each of these affirmations, descriptions, promises and representations were related to the buses and were part of the basis on which the City contracted with BYD.

49. The buses did not conform to each and every affirmation, description, promise and representation made by BYD.

50. The City rightfully rejected the buses.

51. The City justifiably revoked acceptance of the buses it may have accepted.

52. BYD removed the buses, and took possession and ownership of them.

53. As a result of BYD's breaches of express warranties, the City has suffered damages, including incidental and consequential damages.

**Count II**  
**Breach of Implied Warranty of Merchantability**

54. The City incorporates ¶¶ 1-53.

55. BYD is a merchant with respect to the buses that are the subject of this Contract between it and the City.

56. The buses delivered by BYD do not pass without objection in the trade under the Contract description.

57. The buses delivered by BYD are not fit for their ordinary purposes; the City cannot place those buses in operation.

58. The City rightfully rejected the buses.

59. The City justifiably revoked acceptance of any of the buses it may have accepted.

60. BYD removed the buses, and took possession and ownership of them.

61. As a result of BYD's breach of the implied warranty of merchantability, the City has suffered damages, including incidental and consequential damages.

**Count III**

**Breach of Implied Warranty of Fitness for Particular Purpose**

62. The City incorporates ¶¶ 1-61.

63. The City had a particular purpose for each and every bus it agreed to purchase from BYD pursuant to the Contract. That particular purpose was to acquire electric buses that would meet the needs of ART as described in the RFP.

64. At the time of the contract, BYD knew, or had reason to know, of the City's particular purpose.

65. The City relied on BYD to manufacture and deliver buses that conformed to its particular purpose.

66. BYD knew, or had reason to know, that the City was relying on BYD to manufacture and deliver buses that would conform to its particular purpose.

67. The buses that BYD delivered to the City did not conform to the City's particular purpose; they were unsafe and could not be put into operation because of their defects.

68. The City rightfully rejected the buses.

69. The City justifiably revoked acceptance of the buses it may have accepted.

70. BYD removed the buses, and took possession and ownership of them.

71. As a result of BYD's breach of the implied warranty of fitness for a particular purpose, the City has suffered damages, including incidental and consequential damages.

**Count IV**

**Breach of Contract**

72. The City incorporates ¶¶ 1-71.

73. BYD breached its contract with the City, causing the City to suffer damages, including incidental and consequential damages.

**Count V**  
**Fraudulent Misrepresentation**

74. The City incorporates ¶¶ 1-68.

75. BYD intentionally or recklessly misrepresented the material facts concerning the buses, including that they would be free of defects and safe, in order to induce the City to contract with it for the purchase of the buses.

76. BYD intentionally or recklessly misrepresented that the buses would pass Altoona-testing before it delivered any buses.

77. BYD intentionally or recklessly misrepresented that it would provide the City with certificates that the buses complied with federal standards, the RFP and the Proposal, including signed certificates of crashworthiness.

78. BYD intentionally or recklessly misrepresented that it would deliver all the buses that conformed to the Contract no later than the week of October 2, 2017.

79. BYD's misrepresentations were for the purpose of inducing the City to contract with it for the purchase of the buses.

80. The City justifiably relied on those misrepresentations of material facts.

81. The City has suffered injury because of BYD's intentional or reckless misrepresentations of material facts related to the buses, causing the City to suffer damages, including incidental and consequential damages.

**Count VI**  
**Negligent Misrepresentation**

82. The City incorporates ¶¶ 1-81

83. BYD had a duty not to misrepresent that the buses were safe, free of defects, passed Altoona testing, and met all federal and industry standards.

84. BYD reasonably knew, or should have known, of the number and severity of defects in the buses, and that the buses were not safe and were not operational.

85. BYD knew, or should have known, that it could not provide the City with the buses that passed the Altoona testing.

86. BYD knew, or should have known, that it could not provide the City with certificates evidencing that the buses met federal standards, the RFP and the Proposal, including signed certificates that the buses were crash-worthy.

87. BYD knew, or should have known, that it could not deliver buses to the City that conformed to the Contract no later than the week of October 2, 2017.

88. BYD's negligent misrepresentations caused the City to suffer substantial injury.

89. BYD's negligent misrepresentations were the proximate cause of the City's injury.

90. As a result of BYD's negligent misrepresentations, the City has suffered damages, including incidental and consequential damages.

**Count VII**  
**Violation of Unfair Practices Act**

91. The City incorporates ¶¶ 1-90.

92. BYD made oral and written representations concerning the buses that were false or misleading.

93. BYD knowingly made those false or misleading representations in connection with the sale of the buses to the City in the ordinary course of BYD's business, including, but not limited to, representing that the buses would be free of defects; would comport with federal and industry standards and RFP specifications and the Proposal warranties; that the buses would pass Altoona testing; and that the batteries would power the buses for 275 miles on a single charge.

94. Those representations were of the type that would deceive or mislead any person.

95. As a result of BYD's deceptive and misleading representations, the City has suffered substantial damages.

96. BYD willfully engaged in deceptive trade practices, for which the City is entitled to treble damages.

WHEREFORE, the City respectfully prays this Court for:

- A. Damages, including incidental and consequential damages;
- B. Treble damages for BYD's willfully engaging in deceptive practices in violation of the New Mexico Unfair Practices Act;
- C. Punitive damages;
- D. Prejudgment interest;
- E. Attorney fees;
- F. Court costs; and
- G. Such other relief this Court decides is fair and just.

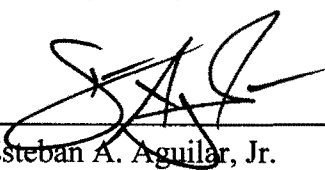
Respectfully submitted,

SANCHEZ, MOWRER & DESIDERIO, P.C.



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## AGREEMENT

**THIS AGREEMENT** is made and entered into this 26<sup>th</sup> day of January, 2017 by and between the City of Albuquerque, New Mexico, a municipal corporation, ("City"), and BYD Motors Inc. ("Contractor"), 1800 S. Figueroa St., Los Angeles, California 90015-3422.

## RECITALS

**WHEREAS**, the City issued a Request For Proposals for the Transit Department, P2016000031, titled "Transit 60-Foot 5 Door BRT Bus Purchase", and Addenda 1, 2, and 3 to the Request for Proposals, all of which is Exhibit A to this Agreement; and

**WHEREAS**, the Contractor submitted its proposal, dated March 15, 2016, in response to P2016000031 which proposal is Exhibit B to this Agreement; and

**WHEREAS**, the Contractor submitted its Best and Final Offer, dated April 8, 2016, in response to the City's request, which is Exhibit C to this Agreement; and

**WHEREAS**, the City desires to engage the Contractor to render certain services in connection therewith, and the Contractor is willing to provide such services.

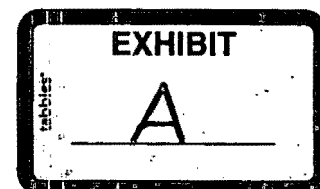
**NOW, THEREFORE**, in consideration of the premises and mutual obligations herein, the parties hereto do mutually agree as follows:

**1. Scope of Services.** The Contractor shall perform the following services ("Services") in a satisfactory and proper manner, as determined by the City:

**A.** The Contractor shall provide eighteen (18) K11 sixty (60) foot five (5) door BRT Buses, in accordance with Exhibit A as supplemented by Exhibit B, Exhibit C, and Exhibit D. The BRT Buses shall each include a 591 kWh battery pack as set forth in Exhibit C (Best and Final Offer). The Contractor shall, at its own expense, provide the City the option to upgrade the 591 kWh battery packs over their twelve (12) year life span in the event of technology changes, advancements, or improvements.

**B.** The Contractor shall, at its own expense, supply two (2) additional K11 BRT Buses, each to include a 591 kWh battery pack as set forth in Exhibit C (Best and Final Offer), with the initial order of eighteen (18) units. Upon reaching the one (1) year mark, as determined from the date of the nineteenth (19<sup>th</sup>) and twentieth (20<sup>th</sup>) BRT Bus acceptance by the City, and having met the pre-determined performance specifications, the City, through the Transit Department, can acquire the two (2) additional BRT Buses at the same price as the first eighteen (18) units or return them to the Contractor with no financial obligation to the City.

**C.** The Contractor shall, at its own expense, place one (1) full time Factory trained technician onsite for one (1) year to help with the delivery and launch of the eighteen (18) sixty (60) foot five (5) door BRT Buses. The Factory trained technician will provide mechanical and first responder training, provide technical support 24/7 to the City's ABQ Ride



vehicle maintenance division, perform warranty repairs, and provide customer service as required by the City.

D. The Contractor shall provide, at its own expense, eighteen (18) additional plug-in battery chargers. Chargers will only be delivered to the City by Contractor upon request by the City. The City may request these additional chargers on an individual or multiple unit basis, based on the needs of the City. Delivery of the charger(s) by the Contractor will occur five (5)-working days from the request from the City. The City can make multiple requests for delivery until all eighteen (18) additional chargers have been delivered.

E. The Contractor shall provide, at its own expense, the exterior bus aesthetics package provided by the City, which includes decals and LED service/accent lighting.

F. The Contractor shall comply with its submitted response to P2016000031, unless mutually agreed upon changes are made.

G. The BRT Bus Delivery Schedule may be modified to better align with the Albuquerque Rapid Transit construction schedule.

2. **Time of Performance.** Services of the Contractor shall commence on the date of final execution of this Agreement and shall be undertaken and completed in accordance with the BRT Bus Delivery Schedule as follows.

#### **BRT BUS DELIVERY SCHEDULE**

Week of June 26, 2017	Delivery of one (1) Pilot BRT Bus
Week of August 28, 2017	Delivery of three (3) BRT Buses
Week of September 4, 2017	Delivery of three (3) BRT Buses
Week of September 11, 2017	Delivery of three (3) BRT Buses
Week of September 18, 2017	Delivery of three (3) BRT Buses
Week of September 25, 2017	Delivery of three (3) BRT Buses
Week of October 2, 2017	Delivery of two (2) BRT Buses
<b>TOTAL</b>	<b>Eighteen (18) BRT Buses</b>

**3. Compensation and Method of Payment.**

**A. Compensation.** For performing the Services specified in Section 1 hereof, the City agrees to pay the Contractor as provided in the Pricing Schedule, attached as Exhibit D, as supplemented by Exhibit C (Best and Final Offer), which includes the purchase of eighteen (18) BRT Bus 591 kWh battery packs. This amount shall include any applicable gross receipts taxes and shall constitute full and complete compensation for the Contractor's Services under this Agreement, including all expenditures made and expenses incurred by the Contractor in performing such Services.

Accordingly, notwithstanding anything provided herein, the City shall not release any funds to the Contractor for any of the bus models anticipated to be provided hereunder until it has received the required completed and approved Bus Testing Report(s), including Altoona testing and Federal Motor Vehicle Safety Standards testing; and, deficiencies or concerns have been remedied by the Contractor to the satisfaction of the City.

**B. Method of Payment.** Such amount shall be paid to the Contractor in installments, which include any applicable gross receipts taxes, as provided in Section SP 5 of the RFP, as supplemented by Exhibit C (Best and Final Offer). Payments shall be made to the Contractor upon completion of each task, upon receipt by the City of a properly documented requisition for payment as determined by the budgetary and fiscal guidelines of the City and on the condition that the Contractor has accomplished the Services to the satisfaction of the City.

**C. Appropriations.** Notwithstanding any other provisions in this Agreement, the terms of this Agreement are contingent upon the City Council of the City of Albuquerque making the appropriations necessary for the performance of this Agreement. If the appropriations required for this Agreement are not made by the City Council, this Agreement may be terminated at the end of the City's then current fiscal year upon the submission of written notice (with objectively verifiably proof of inability to procure vehicles due to insufficient appropriations) by the City to the Contractor. Such event shall not constitute an event of default. All payment obligations of the City and all of its interest in this Agreement will cease upon the date of termination.

**D. Bus Testing Report(s).** The Bus Testing Regulation at 49 C.F.R. Part 665.7(a) states that a recipient of Federal Transit Administration funding must certify that it possesses a copy of the applicable Bus Testing Report(s) before final acceptance of that bus model. The Federal Transit Administration interprets final acceptance as the release of Federal Transit Administration Funds to the manufacturer. Accordingly, notwithstanding anything provided herein, the City shall not release any funds to the Contractor for any of the bus models anticipated to be provided hereunder until it has received the required completed and approved Bus Testing Report(s), including Altoona testing and Federal Motor Vehicle Safety Standards testing; and, with respect to Altoona testing, any class 1-3 deficiencies have been remedied by the Contractor; and, with respect to Federal Motor Vehicle Safety Standard all relevant standards applicable to the bus models have been met by the Contractor. Notwithstanding Exhibit A, Section GC 4. Inspection, Testing and Acceptance, GC 4.1 General and SP 1.4 Post-Delivery Tests, or other provisions of Exhibit A to the contrary, the fifteen (15) day inspection period and

final acceptance is not valid until the City has received the required completed and approved Bus Testing Report(s) from Altoona testing and Federal Motor Vehicle Safety Standards testing.

**4. Liquidated Damages.**

A. It is mutually understood and agreed by and between the parties to this Agreement that time is of the essence with respect to the completion of the Services and that in case of any failure on the part of the Contractor to deliver the BRT Buses within the time specified in Exhibit A, the City will be damaged thereby. Because the amount of said damages, is difficult if not impossible of definite ascertainment and proof, it is hereby agreed that the amount of such damages due to the City shall be fixed at Two Hundred Seventy-Five Dollars (\$275.00) per calendar day per BRT Bus not delivered in substantially good condition as inspected by the City at the time released for shipment.

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

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

**5. Independent Contractor.** The Contractor is considered as an independent contractor at all times in the performance of the services described in Section 1. The Contractor further agrees that neither it nor its employees are entitled to any benefits from the City under the provisions of the Workers' Compensation Act of the State of New Mexico, or to any of the benefits granted to employees of the City under the provisions of the Merit System Ordinance as now enacted or hereafter amended.

**6. Personnel.**

A. The Contractor represents that it has, or will secure at its own expense, all personnel required in performing all of the Services required under this Agreement. Such personnel shall not be employees of or have any contractual relationships with the City.

B. All the Services required hereunder will be performed by the Contractor or under its supervision and all personnel engaged in the work shall be fully qualified and shall be authorized or permitted under state and local law to perform such Services.

C. None of the work or Services covered by this Agreement shall be subcontracted without the prior written approval of the City. Any work or Services



subcontracted hereunder shall be specified by written contract or agreement and shall be subject to each provision of this Agreement.

7. **Indemnity.** The Contractor agrees to defend, indemnify and hold harmless the City and its officials, agents and employees as provided in Exhibit A, Part 3, Section 3.1, General Conditions, Section GC 9.1.1. The indemnity required hereunder shall not be limited by reason of the specification of any particular insurance coverage in this Agreement.

8. **Bonds and Insurance.** The Contractor shall not commence any work under this Agreement until the insurances required in Exhibit A, Section 1.23 and the bonds per the attachments to Exhibit A have been obtained and the proper certificates and riders or endorsements (or policies) have been submitted to the City.

9. **Discrimination Prohibited.** In addition to the requirements provided in Exhibit A, Part 3.1 General Conditions, Section GC 9.12 and Section 4 of the Federal Requirements set forth in the RFP, in performing the Services required hereunder, the Contractor shall not discriminate against any person on the basis of race, color, religion, gender, sexual preference, sexual orientation, national origin or ancestry, age, physical handicap or disability, as defined in the Americans With Disabilities Act of 1990, as currently enacted or hereafter amended.

10. **ADA Compliance.** In performing the Services required hereunder, the Contractor agrees to meet all the requirements of the Americans With Disabilities Act of 1990 (the "ADA"), which are imposed directly on the Contractor or which would be imposed on the City as a public entity. The Contractor agrees to be responsible for knowing all applicable rules and requirements of the ADA and to defend, indemnify and hold harmless the City, its officials, agents and employees from and against any and all claims, actions, suits or proceedings of any kind brought against said parties as a result of any acts or omissions of the Contractor or its agents in violation of the ADA.

11. **Reports and Information.** At such times and in such forms as the City may require, there shall be furnished to the City such statements, records, reports, data and information, as the City may request pertaining to matters covered by this Agreement. Unless authorized by the City, the Contractor will not release any information concerning the work product including any reports or other documents prepared pursuant to the Agreement until the final product is submitted to the City.

12. *This section intentionally left blank.*

13. **Establishment and Maintenance of Records.** In addition to the requirements provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.4.2, records shall be maintained by the Contractor in accordance with applicable law and requirements prescribed by the City with respect to all matters covered by this Agreement. Except as otherwise authorized by the City, such records shall be maintained for a period of three (3) years after receipt of final payment under this Agreement.

14. **Audits and Inspections.** The Contractor agrees to comply with the following in addition to Exhibit A, Part 3.1, General Conditions, Section GC 9.4.2 and Section 1 of the Federal Requirements set forth in the RFP. At any time during normal business hours and as often as the City may deem necessary, there shall be made available to the City for examination all of the Contractor's records with respect to all matters covered by this Agreement. The Contractor shall permit the City to audit, examine, and make excerpts or transcripts from such records, and to make audits of all contracts, invoices, materials, payrolls, records of personnel, conditions of employment and other data relating to all matters covered by this Agreement. The Contractor understands and will comply with the City's Accountability in Government Ordinance, §2-10-1 et seq. and Inspector General Ordinance, §2-17-1 et seq. R.O.A. 1994, and also agrees to provide requested information and records and appear as a witness in hearings for the City's Board of Ethics and Campaign Practices pursuant to Article XII, Section 8 of the Albuquerque City Charter.

15. **Publication, Reproduction and Use of Material.** No material produced in whole or in part under this Agreement shall be subject to copyright in the United States or in any other country. The City shall have unrestricted authority to publish, disclose, distribute and otherwise use, in whole or in part, any reports, data or other materials prepared under this Agreement.

16. **Compliance with Laws.** In addition to the requirement provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.5, in providing the Scope of Services outlined herein, the Contractor shall comply with all applicable laws, ordinances, and codes of the federal, State, and local governments.

17. **Changes.** The City and the Contractor may, from time to time, request changes in the Scope of Services of the Contractor to be performed hereunder. Such changes, including any increase or decrease in the amount of the Contractor's compensation, shall not be operative unless mutually agreed upon by and between the City and the Contractor in a signed written document and incorporated as an amendment to this Agreement.

18. **Assignability.** The Contractor shall not assign any interest in this Agreement and shall not transfer any interest in this Agreement (whether by assignment or novation), without the prior written consent of the City thereto.

19. **Termination for Cause.** Termination for cause shall be as provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.42.

20. **Termination for Convenience of City.** Termination for convenience shall be as provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.41.

21. **Dispute Resolution.** Dispute resolution shall be as provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.8.

22. **Construction and Severability.** If any part of this Agreement is held to be invalid or unenforceable, such holding will not affect the validity or enforceability of any other

part of this Agreement so long as the remainder of the Agreement is reasonably capable of completion.

23. **Enforcement.** The Contractor agrees to pay to the City all costs and expenses including reasonable attorney's fees incurred by the City in exercising any of its rights or remedies in connection with the enforcement of this Agreement.

24. **Entire Agreement.** This Agreement contains the entire agreement of the parties and supersedes any and all other agreements or understandings, oral or written, whether previous to the execution hereof or contemporaneous herewith. Exhibits A, B, C, and D, attached hereto, are hereby made a part of this Agreement.

By signing this Agreement, the Contractor expressly agrees that the General Conditions, Special Provisions, and Federal Requirements set forth in the RFP are incorporated herein.

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

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


27. **Applicable Law.** This Agreement shall be governed by and construed and enforced in accordance with the laws of the State of New Mexico, and the laws, rules and regulations of the City of Albuquerque.

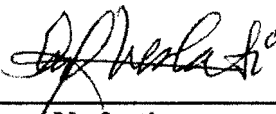
28. **Approval Required.** This Agreement shall not become binding upon the City until approved by the highest approval authority of the City required under this Agreement.

IN WITNESS WHEREOF, the City and the Contractor have executed this Agreement as of the date first above written.

**CITY OF ALBUQUERQUE**

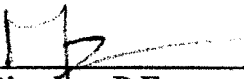
**BYD MOTORS INC.**

*JMP*  
  
\_\_\_\_\_  
**Robert J. Perry**  
Chief Administrative Officer

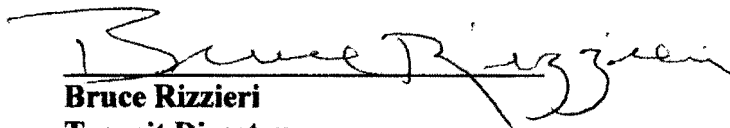
  
\_\_\_\_\_  
**Macy Neshati**  
Senior Vice President, Sales

Date: 1/26/17

Date: 12/29/16

  
\_\_\_\_\_  
**Michael J. Riordan, P.E.**  
Chief Operations Officer

Date: 1/25/17

  
\_\_\_\_\_  
**Bruce Rizzieri**  
Transit Director

Date: 2017.01.09

  
\_\_\_\_\_  
**Ramona C. Martinez**  
Chief Procurement Officer

Date: 1/13/17



**APPENDIX M-2**  
**Pricing Schedule**

	All prices are to be in United States dollars	
	Unit Price	Extension
<b>(18) - Sixty-foot five-door BRT ELECTRIC Buses</b>	\$1,249,337.00*	\$22,488,066.00
Manuals	Lump Sum	Included In Unit Price
Training	Lump Sum	Included In Unit Price
Spare parts package	See Attachment	\$282,484.63
Test equipment and special tools	No Special Tools Required	No Special Tools Required
Extended Warranty [City to identify subsystem]		
Extended Warranty [City to identify subsystem]		
Extended Warranty [City to identify subsystem]		
Extended Warranty [City to identify subsystem]		
Other [City to specify] Momentum Dynamics Pricing	\$70,000.00Secondary \$400,000.00 Primary	SecondaryX18= \$1,260,000 Primary X 2= \$800,000.00 Total: \$2,060,000.00
Sales tax (CA 9%)	\$150,945.70	\$2,141,022.60
Delivery charges	\$5,000.00	\$90,000.00
<b>TOTAL PROPOSED PRICE</b>		\$27,389,958.10
ADA equipment (included in above unit prices)	\$42,162.50	\$758,925.00

This form is to be completed and included in the Cost Proposal.

\*BYD's Depot Charger is Included In the Unit Price of Each Bus.

\*\*See attachment for a break down of options pricing from your RFP

Options Pricing					
Technical Specifications	Vendor	Description	Qty Per Bus	Unit Price	Total
76.10 Bicycle Storage Area	Sportworks	Interlock	3	\$974.05	\$2,922.15
82.2 Optional Infotainment System	Hanover	Infotainment System	1	\$11,040.00	\$11,040.00
84.5 Automatic Passenger Counter	Clever Devices	APC	1	\$16,005.70	\$16,005.70
84.7 On-Board Traffic Signal Priority	Clever Devices	IVN4 Vehicle Logic Unit	1	\$40,872.15	\$40,872.15

**City of Albuquerque**

**Request for Proposals**

**Solicitation Number: P2016000031**

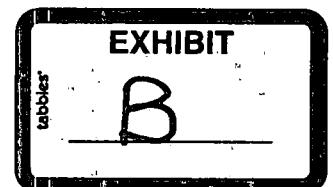
**Transit 60-Foot 5 Door BRT Bus Purchase**  
**February 4, 2016**



**Deadline for Receipt of Proposals: March 8, 2016: 4:00 p.m. (Mountain Time)**  
**The City eProcurement System will not allow proposals to be submitted after this date and time.**

**Pre-proposal Conference: February 18, 2016 @ 2:00pm**

**City of Albuquerque**  
**Department of Finance and Administrative Services**  
**Purchasing Division**



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### Appendices



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Appendix B	Contractor Service and Parts Support Data
Appendix C	Form for Proposal Deviation (without price data)
Appendix D	Vehicle Questionnaire
Appendix E	Buy America Certification
Appendix F	Debarment and Suspension Certification for Prospective Contractor
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Appendix H	Non-Collusion Affidavit
Appendix I	Lobbying Certification
Appendix J	Certificate of Compliance with Bus Testing Requirement
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Appendix L	Federal Motor Vehicle Safety Standards
Appendix M	Pricing Schedule
Appendix N	Performance Bond

## INTRODUCTION

The City of Albuquerque Transit Department ("City") requests Proposals for the manufacture and delivery of 60-foot 5-door low floor bus rapid transit ("BRT") buses in accordance with the terms and conditions set forth in RFP P2016000031. The contract resulting from this RFP shall be a firm-fixed price contract for eighteen (18) – 60-foot 5-door low floor buses with the option of manufacture and delivery of an additional twelve (12) 60-foot 5-door low floor BRT buses over a five (5) year period, bringing the possible combined total number of diesel-powered and/or electric-powered buses to be delivered during the five (5) year term of the contract to thirty (30).

The City currently has a fleet of 157 buses, which includes 24 – 60- foot Articulated buses and 133 – 40-foot buses. The City will be providing BRT service along Central Avenue. This BRT project named Albuquerque Rapid Transit ("ART"), will enhance transit service along this important east-west corridor. It will feature: dedicated bus lanes with center median stations, curb lane stations, mixed flow curb lanes, level boarding, off board fare payment, and signal prioritization.

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**PART 1  
INSTRUCTIONS TO OFFERORS**

**1.1 RFP Number and Title:** P2016000031, **"Transit 60-Foot 5-Door BRT Bus Purchase"**

**1.2 Proposal Due Date: March 8, 2016 - NLT 4:00 PM (Local Time)**

The time and date Proposals are due shall be strictly observed.

**1.2.1 Non-Mandatory Pre-Proposal Conference:** This is not a mandatory Pre-Proposal Conference, but highly recommended. Those Offerors who choose not to attend shall be solely responsible for obtaining any additional information, clarifications or addenda resulting from this meeting.

The Non-Mandatory Pre-Proposal Conference will be held on February 18, 2016. The Conference will convene at 2:00 p.m. in the Transit Department's Training Room, located at 100 First Ave. SE, Albuquerque, NM 87102.

Offerors are requested to submit written questions to the City Contact, identified in Section 1.6 below, in advance of the Pre-Proposal Conference. In addition, questions may be submitted up to 20 business days before the Proposal Due Date. Responses will be shared with all Offerors at least 10 days prior to the Proposal Due Date. Offerors are reminded that any changes to this RFP will be by written addenda only, and nothing stated at the Pre-Proposal Conference shall change or qualify in any way any of the provisions in the RFP and shall not be binding on the City.

**1.3 Purchasing Division:** This RFP is issued on behalf of the City of Albuquerque by its Purchasing Division, which is the sole point of contact during the entire procurement process.

**1.4 Authority:** Chapter 5, Article 5 of the Revised Ordinances of the City of Albuquerque, 1994, (the "Public Purchases Ordinance"). The City Council, pursuant to Article 1 of the Charter of the City of Albuquerque and Article X, Section 6 of the Constitution of New Mexico, has enacted this Public Purchases Ordinance as authorized by such provisions and for the purpose of providing maximum local self-government. To that end, it is intended that this Public Purchases Ordinance shall govern all purchasing transactions of the City and shall serve to exempt the City from all provisions of the New Mexico Procurement Code, as provided in Section 13-1-98K, NMSA 1978.

**1.5 Acceptance of Proposal:** Acceptance of Proposal is contingent upon Offeror's certification and agreement by submittal of its Proposal, to comply and act in accordance with all provisions of the following:

**1.5.1 City Public Purchases Ordinance**

**1.5.2 City Purchasing Rules and Regulations:** These Rules and Regulations (the "Regulations") are written to clarify and implement the provisions of the Public Purchases Ordinance. These Regulations establish policies, procedures, and guidelines relating to the procurement, management, control, and disposal of goods, services, and construction, as applicable, under the authority of the Public Purchases Ordinance.

**1.5.3 Civil Rights Compliance:** Acceptance of Proposal is contingent upon the Offeror's certification and agreement by submittal of its Proposal, to comply and act in accordance with all

provisions of the Albuquerque Human Rights Ordinance, the New Mexico Human Rights Act, Title VII of the U.S. Civil Rights Act of 1964, as amended, and all federal statutes and executive orders, New Mexico statutes and City of Albuquerque ordinances and resolutions relating to the enforcement of civil rights and affirmative action. Questions regarding civil rights or affirmative action compliance requirements should be directed to the City of Albuquerque Human Rights Office.

**1.5.4 Americans with Disabilities Act Compliance:** Offeror certifies and agrees, by submittal of its Proposal, to comply and act in accordance with all applicable provisions of the Americans With Disabilities Act of 1990 and federal regulations promulgated thereunder.

**1.5.5 Insurance and Bonding Compliance:** Acceptance of Proposal is contingent upon Offeror's ability to comply with the insurance requirements as stated herein. Please include a certificate or statement of compliance in your proposal and bonds as required.

**1.5.6 Ethics:**

**1.5.6.1 Fair Dealing.** The Offeror warrants that its proposal is submitted and entered into without collusion on the part of the Offeror with any person or firm, without fraud and in good faith. Offeror also warrants that no gratuities, in the form of entertainment, gifts or otherwise, were, or will be offered or given by the Offeror, or any agent or representative of the Offeror to any officer or employee of the City with a view toward securing a recommendation of award or subsequent contract or for securing more favorable treatment with respect to making a recommendation of award.

**1.5.6.2 Conflict of Interest.** The Offeror warrants that it presently has no interest and shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of services required under the contract resulting from this RFP. The Offeror also warrants that, to the best of its knowledge, no officer, agent or employee of the City who shall participate in any decision relating to this RFP and the resulting contract, currently has, or will have in the future, a personal or pecuniary interest in the Offeror's business.

**1.5.7 Participation/Offeror Preparation:** Offeror may not use the consultation or assistance of any person, firm company who has participated in whole or in part in the writing of these specifications or the Scope of Services, for the preparation of its Proposal or in the management of its business if awarded the contract resulting from this RFP.

**1.5.8 Debarment or Ineligibility Compliance:** By submitting its proposal in response to this RFP, the Offeror certifies that (i) it has not been debarred or otherwise found ineligible to receive funds by any agency of the federal government, the State of New Mexico, any local public body of the State, or any state of the United States; and (ii) should any notice of debarment, suspension, ineligibility or exclusion be received by the Offeror, the Offeror will notify the City immediately.

Any proposal received from an Offeror that is, at the time of submitting its proposal or prior to receipt of award of a contract, debarred by or otherwise ineligible to receive funds from any agency of the federal government, the State of New Mexico, any local public body of the State, or any state of the United States, shall be rejected.

Upon receipt of notice of debarment of an Offeror awarded a contract as a result of this RFP (the "Contractor"), or other ineligibility of the Contractor to receive funds from any agency of the federal government, the State of New Mexico, any local public body of the State, or any state of the United States, the City shall have the right to cancel the contract with the Contractor resulting from this RFP for cause in accordance with the terms of said contract.

**1.5.9 Goods Produced Under Decent Working Conditions:** It is the policy of the City not to purchase, lease, or rent goods for use or for resale at City owned enterprises that were produced under sweatshop conditions. The Offeror certifies, by submittal of its Proposal in response to this solicitation, that the goods offered to the City were produced under decent working conditions. The City defines "under decent working conditions" as production in a factory in which child labor and forced labor are not employed; in which adequate wages and benefits are paid to workers; in which workers are not required to work more than 48 hours per week (or less if a shorter workweek applies); in which employees are free from physical, sexual or verbal harassment; and in which employees can speak freely about working conditions and can participate in and form unions. [Council Bill No. M-8, Enactment No. 9-1998]

**1.5.10 Graffiti Free:** When required, the Contractor will be required to furnish equipment, facilities, or other items required to complete these services, that are graffiti-free. Failure of Contractor to comply with this requirement may result in cancellation of the contract resulting from this RFP.

**1.6 City Contact:** The sole point of contact for this Request for Proposals is the City of Albuquerque Purchasing Division. Questions regarding this RFP should be directed to the following Purchasing representative for this solicitation through the online eProcurement system unless otherwise specified in the solicitation:

René Diaz – Purchasing Specialist  
Department of Finance and Administrative Services, Purchasing Division  
Phone: (505) 768- 3344 or E-Mail: rdiaz@cabq.gov  
Post Office Box 1293, Albuquerque, New Mexico 87103

**1.7 Contract Management:** The contract resulting from this RFP will be managed by the City of Albuquerque Transit Department by:

Chris Payton, Fiscal Manager  
City of Albuquerque, ABQ RIDE  
8001 Daytona Rd. NW  
Albuquerque, New Mexico 87120  
cpayton@cabq.gov

**1.8 Clarification:** Any explanation desired by an Offeror regarding the meaning or interpretation of this Request For Proposals must be requested in writing not less than ten (10) working days prior to the deadline for the receipt of Proposals to allow sufficient time for a reply to reach all Offerors before the submission of their Proposals. No extension of time will be granted based on submission of inquiries subsequent to the required date nor will such inquiries be answered. All inquiries must be directed to the Purchasing Division as stated herein. Oral explanations or instructions given before the award of the contract or at any time will not be binding. All answers will be posted to the online eProcurement System and will constitute Addenda to this Request for Proposals.

**1.9 Submission of Proposals.** The Offeror's sealed Proposal **must be submitted both in hard copy** (see Sections 1.9.5 through 1.9.7) **as well as electronically through the eProcurement system** (see Section 1.9.1) in the format outlined in Part 2 of this RFP and mailed or delivered pursuant to the following requirements:

**1.9.1 Electronic Copy.** Submit your complete Proposal including all forms, attachments, exhibits, Technical Proposal, Cost Proposal, etc. using the eProcurement System at <http://www.cabq.gov/dfa/purchasing/solicitations/solicitations>. If you do not have a username and password, please register as this is the only method to submit electronically on Sicomm.net. For assistance, please contact the Sicomm.net technical support at (800) 614-0563 or (505) 341-9201.

**1.9.2 Hard Copy.** In addition to the electronic submittal, Offeror must also submit one (1) original and six (6) copies of its Technical Proposal. The original Proposal shall be clearly marked as "Original" on the cover of the Proposal. In addition, in a separate envelope, clearly marked as "Cost Proposal," submit one (1) original and six (6) copies of your Cost Proposal for this RFP.

**1.9.3 Soft Copy.** In addition to the electronic copy, include with your original hard copy Proposal submission, on a CD, DVD, or other media compatible with the City's system, an electronic file of your Technical and Cost Proposals as well as all forms, attachments, exhibits, etc.

**1.9.4 Proposal Package Preparation.** Proposals and modifications thereof shall be enclosed in sealed envelopes and have the following identifying information on the outside:

- Name and Address of Offeror
- Closing Date and Time of RFP
- RFP Number
- RFP Title

**1.9.5 Ship, Deliver, or Hand-Carry Sealed Proposals to:** Office of the City Clerk, 600 Second St. NW, Plaza Del Sol, 7<sup>th</sup> Floor Room 720, Albuquerque, New Mexico 87102. **Mark all packages as stated above.** Use this address for packages sent via non United States Postal Service carriers.

**1.9.6 Mail Sealed Proposals to:** Office of the City Clerk, Post Office Box 1293, Albuquerque, New Mexico 87103. (Certified Mail is recommended). The City shall not be responsible for the failure of mailed Proposals to actually be received by the Office of the City Clerk by 4:00 PM (Mountain Time) of the day of closing.

**ALL SEALED PROPOSALS MUST BE RECEIVED BY THE OFFICE OF THE CITY CLERK AS SPECIFIED HEREIN.**

**1.9.7 No other methods of offer delivery.** Neither telephone, facsimile, nor telegraphic Proposals shall be accepted.

**1.9.8 Modification.** Proposal may be modified or withdrawn only by written notice, provided such notice is received prior to the Proposal Due Date.

**1.9.9 Receipt of Proposals.** The only acceptable evidence to establish the time of receipt of Proposals at the City Clerk's Office is the time-date stamp of that Office on the Proposal wrapper or other  
P2016000031, "Transit 60-Foot 5-Door BRT Bus Purchase"



documentary evidence of receipt maintained by that Office. Since both electronic and hard copy submission is required, the City will treat the time-stamp of the later of the two receipts as the official documentary evidence of receipt.

**1.9.10 Acknowledgment of Addenda or Amendments to the Request for Proposals.** Receipt of Addenda to this RFP by an Offeror must be acknowledged a) by signing and returning the Addenda or Amendment, or b) by letter. Such acknowledgment may be submitted with the Proposal. Such acknowledgment must be received prior to the hour and date specified for receipt of Proposals. Acknowledgement of Amendments must be submitted prior to the deadline indicated therein.

**1.10 Modifications to Scope of Services:** In the event that sufficient funds do not become available to complete each task in the Scope of Services, the Scope of Services may be amended, based upon the cost breakdown required in the Cost Proposal.

**1.11 Draft Agreement:** A copy of the Draft Agreement to be entered into is included in the RFP. Please state that you accept the terms and conditions of the Draft Agreement, or note exceptions. The Draft Agreement may differ from the final Agreement.

**1.12 Contract Term:** The contract resulting from this RFP is anticipated to have a term of five (5) years.

**1.13 Evaluation Period:** The City reserves the right to analyze, examine and interpret any Proposal for a period of ninety (90) days after the hour and date specified for the receipt of Proposals.

**1.14 Evaluation Assistance:** The City, in evaluating Proposals, reserves the right to use any assistance deemed advisable, including City contractors and consultants.

**1.15 Rejection and Waiver:** The City reserves the right to reject any or all Proposals and to waive informalities and minor irregularities in Proposals received.

**1.16 Award of Contract:**

**1.16.1 When Award Occurs:** Award of contract occurs when a Purchase Order is issued or other evidence of acceptance by the City is provided to the Offeror. A Recommendation of Award does not constitute award of contract.

**1.16.2 Award:** If a contract is awarded, it shall be awarded to the responsive and responsible Offeror whose Proposal conforming to this RFP will be most advantageous to the City as set forth in the Evaluation Criteria.

**1.17 Cancellation:** This RFP may be canceled for any reasons and any and all Proposals may be rejected in whole or in part when it is in the best interests of the City.

**1.18 Negotiations:** Negotiations may be conducted with the Offeror(s) recommended for award of contract.

**1.19 City-Furnished Property:** No material, labor, or facilities will be furnished by the City unless otherwise provided for in this RFP.

**1.20 Proprietary Data:** The file and any documents relating to this RFP, including the Proposals submitted by Offerors, shall be open to public inspection after the recommendation of award of a contract has been signed by the Mayor, or his designee. An Offeror may designate trade secrets or other proprietary data to be confidential by separating that material from the Offeror's main Proposal, marking it as "Confidential" and uploading it separately from its main proposal submitted in response to this RFP. **Pricing and makes and models or catalog numbers of items offered, delivery terms, and terms of payment should not be so designated.** The City will endeavor to restrict distribution of material separated, designated as "Confidential" and provided separately to only those individuals involved in the review and analysis of the proposals. If a request for inspection of records under the New Mexico Inspection of Public Records Act (Sections 14-2-1 et seq, NMSA 1978) is received, however, which request encompasses such materials, they will be disclosed. The City assumes no responsibility to maintain the confidentiality of any materials submitted in response to this RFP. Any Proposal in which a majority of pages are marked as confidential without an apparent justification shall be deemed nonresponsive.

**1.21 Preferences:** Preferences are not applicable to this procurement, as it involves the expenditure of federal funds.

## **1.22 REQUEST FOR PROPOSALS (RFP) PROTEST PROCESS:**

**1.22.1 When:** If the protest concerns the specifications for a competitive solicitation or other matters pertaining to the solicitation documents, it must be received by the Chief Procurement Officer no later than 5:00 p.m. of the tenth business day prior to the deadline for the receipt of Proposals.

**1.22.2 Recommendation of Award:** If the protest concerns other matters relating to this solicitation, the protest must be filed with the Chief Procurement Officer no later than 5:00 p.m. of the tenth business day after the receipt of notice of the Recommendation of Award.

**1.22.3 Timely Protests:** Protests must be received by the Chief Procurement Officer prior to the appropriate deadline as set out herein, or they will not be considered valid. The Chief Procurement Officer may waive the deadline for good cause, including a delay caused by the fault of the City. Late delivery by the U.S. Postal Service or other carrier shall not be considered good cause.

**1.22.4 How to File:** Any Offeror who is aggrieved in connection with a competitive solicitation or recommendation of award of a contract may protest to the City Chief Procurement Officer. The protest shall be addressed to the Chief Procurement Officer, must be submitted in written form and must be legible. Protests may be hand-delivered or mailed. Facsimile, telephonic, telegraphic or electronic protests will not be accepted.

**1.22.5 Required Information:** The protest shall contain at a minimum the following;

- The name and address of the protesting party;
- The number of the competitive solicitation;
- A clear statement of the reason(s) for the protest detailing the provisions believed to have been violated;
- Details concerning the facts, which support the protest;
- Attachments of any written evidence available to substantiate the claims of the protest; and
- A statement specifying the ruling requested.



#### **1.22.6 Address Letters and Envelopes as Follows:**

City of Albuquerque	RFP Number
Purchasing Division	PROTEST
Attn: Chief Procurement Officer	
PO Box 1293	
Albuquerque, New Mexico 87103	

**1.22.7 Protest Response by Chief Procurement Officer:** The Chief Procurement Officer will, after evaluation of a protest, issue a response. Only the issues outlined in the written protest will be considered by the Chief Procurement Officer.

**1.22.8 Protest Hearing:** If a hearing is requested, the request must be included in the protest and received within the time limit. The filing fee of twenty dollars (\$20.00) must accompany the request for hearing. Only the issues outlined in the protest will be considered by the Chief Procurement Officer, or may be raised at a protest hearing. The granting of a hearing shall be at the discretion of the Chief Procurement Officer following review of the request.

### **1.23 INSURANCE:**

**1.23.1 General Conditions:** The City will require the successful Offeror, referred to as the Contractor in this Section, to procure and maintain at its expense during the term of the contract resulting from the RFP, insurance in the kinds and amounts hereinafter provided with insurance companies authorized to do business in the State of New Mexico, covering all operations of the Contractor under the contract. Upon execution of the contract and on the renewal of all coverages, the Contractor shall furnish to the City a certificate or certificates in form satisfactory to the City as well as the rider or endorsement showing that it has complied with these insurance requirements. All certificates of insurance shall provide that thirty (30) days written notice be given to the Risk Manager, Department of Finance and Administrative Services, City of Albuquerque, P.O. Box 470, Albuquerque, New Mexico, 87103, before a policy is canceled, materially changed, or not renewed. Various types of required insurance may be written in one or more policies. With respect to all coverages required other than professional liability or workers' compensation, the City shall be named an additional insured. All coverages afforded shall be primary with respect to operations provided.

**1.23.2 Approval of Insurance:** Even though the Contractor may have been given notice to proceed, it shall not begin any work under the contract resulting from this RFP until the required insurance has been obtained and the proper certificates (or policies) filed with the City. Neither approval nor failure to disapprove certificates, policies, or the insurance by the City shall relieve the Contractor of full responsibility to maintain the required insurance in full force and effect. If part of the contract is sublet, the Contractor shall include any or all subcontractors in its insurance policies, or require the subcontractor to secure insurance to protect itself against all hazards enumerated herein, which are not covered by the Contractor's insurance policies.

**1.23.3 Coverage Required:** The kinds and amounts of insurance required are as follows:

**1.23.3.1 Commercial General Liability Insurance.** A commercial general liability insurance policy with combined limits of liability for bodily injury or property damage as follows:

\$1,000,000	Per Occurrence
\$1,000,000	Policy Aggregate
\$1,000,000	Products Liability/Completed Operations
\$1,000,000	Personal and Advertising Injury
\$ 50,000	Fire Legal
\$ 5,000	Medical Payments

Said policy of insurance must include coverage for all operations performed for the City by the Contractor and contractual liability coverage shall specifically insure the hold harmless provisions of the contract resulting from this RFP.

**1.23.3.2 Automobile Liability Insurance.** A comprehensive automobile liability insurance policy with liability limits in amounts not less than \$1,000,000 combined single limit of liability for bodily injury, including death, and property damage in any one occurrence. The policy must include coverage for the use of all owned, non-owned, hired automobiles, vehicles and other equipment both on and off work.

**1.23.3.3 Workers' Compensation Insurance.** Workers' compensation insurance policy for the Contractor's employees, in accordance with the provisions of the Workers' Compensation Act of the State of New Mexico, (the "Act"). If the Contractor employs fewer than three employees and has determined that it is not subject to the Act, it will certify, in a signed statement, that it is not subject to the Act. The Contractor will notify the City and comply with the Act should it employ three or more persons during the term of the contract resulting from this RFP.

**1.23.4 Increased Limits:** During the life of the contract the City may require the Contractor to increase the maximum limits of any insurance required herein. In the event that the Contractor is so required to increase the limits of such insurance, an appropriate adjustment in the contract amount will be made.

**1.23.5 Additional Insurance:** The City may, as a condition of award of a contract, require a successful Offeror to carry additional types of insurance. The type and limit of additional insurance is dependent upon the type of services provided via the contract by the successful Offeror.

**1.24 PERFORMANCE BOND:** To ensure the faithful performance under the contract resulting from this RFP, the Offeror shall furnish, at its own expense, either a performance guarantee in the form of a cashier's check, a letter of credit in a form approved by the City before Proposal submission, or a performance bond issued on the form attached to this RFP by a surety duly licensed to do business in the state of New Mexico listed on the Department of Treasury's listing of certified companies in an amount equal to one hundred percent of the Proposal. The bond must be furnished prior to or at the time of the issuance of purchase order, but no later than fifteen (15) calendar days after the date of receipt of a written notice of award of a contract awarded under this RFP. The Offeror must be named as a principal on the bonds. No third party bonds will be accepted. The bond shall cover all of the Offeror's obligations under the Contract except for the warranty and shall remain in force until said obligations have been fulfilled.

In the case that a surety becomes insolvent, its license is revoked or suspended, or in the case of a surety approved on the basis that it is listed as an approved federal surety and such federal approval is revoked or suspended, the successful Offeror, within five (5) days after notice by the City, shall substitute other and sufficient surety or sureties. If the successful Offeror fails to do so, such failure shall be a cause for termination of the contract resulting from this RFP.

**1.25 PAY EQUITY DOCUMENTATION:** All Proposals shall include a Pay Equity Reporting Form which can be accessed at <http://www.cabq.gov/womens-pay-equity-task-force-instructions/albuquerque-pay-equity-initiative-instructions> or in the Solicitation Instructions. Offerors who believe they are exempt because they are an out-of-state contractor that has no facilities and no employees working in New Mexico are not required to report data, but must check the box verifying their status on the Pay Equity Reporting Form. Any Proposal that does not include a Pay Equity Reporting Form shall be deemed nonresponsive.

## **PART 2 PROPOSAL FORMAT**

### **2.1 Technical Proposal Format**

**2.1.1 Offeror Identification:** State name and address of your organization or office and nature of organization (individual, partnership or corporation, private or public, profit or non-profit). Subcontractors, if any, must be identified in a similar manner. Include name and telephone number of person(s) in your organization authorized to execute the Draft Agreement. Submit a statement of compliance with all laws stated herein. Submit a statement of agreement of the terms and conditions of the Draft Agreement; state exceptions. Show receipt of Addenda if applicable. Provide a statement or show ability to carry the insurance specified.

#### **2.1.2 Experience:**

2.1.2.1 The Offeror shall complete and include with its Proposal the Pre-Award Evaluation Data Form, in the form attached as Appendix A.

2.1.2.2. The Offeror shall include with its Proposal resumes and an explanation of the experience of the proposed Project Management team, including the experience of key personnel, and the experience of technical personnel supporting each area of technical expertise as required by the Technical Specifications, including test and system integration personnel.

2.1.2.3 The Offeror shall include with its Proposal the history of the organization, including information about manufacturing capabilities.

2.1.2.4 The Offeror shall include with its Proposal its experience in producing the same or similar vehicles as those being proposed, with emphasis on experience in producing Clean Diesel vehicles.

2.1.2.5 The Offeror shall include with its Proposal its experience in producing composite structure vehicles.

2.1.2.6 The Offeror shall include with its Proposal its maintenance and warranty experience, including a description of its qualified staff to provide the necessary services; identification of proposed parts and service centers; service center staffing and qualifications; availability of electronic maintenance documentation and comprehensive plan for providing technical updates for the life of the proposed vehicles; proposed availability of spare parts, including methodology for storing parts locally and for expediting needed parts; proposed training plans and instruction program; proposed diagnostic equipment required to maintain the vehicles; and provision of advanced features such as wireless self-diagnostics and/or database management.

2.1.2.7 The Offeror shall include with its Proposal its ISO certification(s) or equivalent.

2.1.2.8 The Offeror shall include with its Proposal the names, contact information, and relationship of three (3) business references whom the City may contact regarding the Offeror's product and other relevant information.

2.1.2.9. The Offeror shall include with its Proposal information relating to whether the City may inspect and test drive an existing bus with similar specifications as to those set forth in this RFP.

### **2.1.3 Required Documentation and Information:**

2.1.3.1 The Offeror shall complete and include with its Proposal Contractor Service and Parts Support Data, in the form attached at Appendix B.

2.1.3.2 The Offeror shall complete and include with its Proposal the Form for Proposal Deviation (without price data), in the form attached at Appendix C.

2.1.3.3 The Offeror shall complete and include with its Proposal the Vehicle Questionnaire, in the form attached as Appendix D.

2.1.3.4 The Offeror shall include with its Proposal a Production and Delivery Schedule ("Delivery Schedule") and other contract commitments for the duration of the anticipated contract with the City.

2.1.3.5 The Offeror shall include with its Proposal a Project Management Plan.

2.1.3.6 The Offeror shall include a letter from a surety stipulating that the Offeror can obtain the required performance bond. No pricing information shall be provided in this letter.

### **2.1.4 Financial**

2.1.4.1 A copy of the three (3) most recent financial statements audited by an independent third party or a statement from the Offeror regarding how financial information may be reviewed by the City

2.1.4.2 Letter of Commitment for Financial Guarantee: A letter of commitment, signed by an officer of the parent stipulating the willingness of the parent company to provide financial guarantee.

### **2.1.5 Federal Certifications:**

2.1.5.1 The Offeror shall complete and include with its Proposal a Buy America Certification, in the form attached as Appendix E.

2.1.5.2 The Offeror shall complete and include with its Proposal a Debarment and Suspension Certification for Prospective Contractor, in the form attached as Appendix F.

2.1.5.3 The Offeror shall complete and include with its Proposal a Debarment and Suspension Certification (Lower-Tier Covered Transaction), in the form attached as Appendix G.

2.1.5.4 The Offeror shall complete and include with its Proposal a Non-Collusion Affidavit, in the form attached as Appendix H.

2.1.5.5 The Offeror shall complete and include with its Proposal a Lobbying Certification, in the form attached as Appendix I.

2.1.5.6 The Offeror shall complete and include with its Proposal a Certificate of Compliance with Bus Testing Requirement, in the form attached as Appendix J.

2.1.5.7 The Offeror shall complete and include with its Proposal a DBE Approval Certification, in the form attached as Appendix K

2.1.5.8 The Offeror shall complete and include with its Proposal the Federal Motor Vehicle Safety Standards, in the form attached as Appendix L.

## **2.2 Cost Proposal Format, Section Two**

**2.2.1 Total Cost:** Submit your Cost Proposal separately from your technical proposal, as follows:

The Offeror shall complete and include with its Cost Proposal the Pricing Schedules in the formats attached as Appendix M-1 for diesel-powered buses and M-2 for electric-powered buses. Offerors that manufacture only diesel powered, 60', 5-door buses may submit proposals based on the diesel bus specifications. Offerors that manufacture only electric powered, 60', 5-door buses may submit proposals based on the electric bus specifications. Offerors that manufacture both diesel powered and electric powered, 60', 5-door buses may submit proposals based on either the diesel bus or electric bus specifications, or both specifications.

**2.2.2 All Costs:** All costs to be incurred and billed to the City should be described by the Offeror for each item, to allow for a clear evaluation and comparison, relative to other proposals received. All costs should include any applicable gross receipts taxes. The Offeror should understand that the City will not pay for any amounts not included in the Cost Proposal -- for example, insurance or taxes -- and that liability for items not included remains with the Offeror.

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## **PART 3 SCOPE OF SERVICES**

### **SECTION 3.1**

#### **GENERAL CONDITIONS TO THE CONTRACT RESULTING FROM THIS RFP**

##### ***GC 1. Definitions***

The following are definitions of special terms used in this Part 3:

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

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

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

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

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

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

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

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

**Supplier:** Any manufacturer, company or agency providing units, components or subassemblies for inclusion in the bus that are installed by the successful Offeror. Supplier items shall require qualification by type and acceptance tests in accordance with requirements defined in the “Quality Assurance” section of this Part 3, Scope of Services.

**Subcontractor:** Any manufacturer, company or agency providing units, components or subassemblies for inclusion in the bus that are installed by a Subcontractor. Subcontractor items shall require qualification by type and acceptance tests in accordance with requirements defined in the “Quality Assurance” section of this Part 3, Scope of Services.

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

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

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



or except insofar as the damage to such equipment is caused by the successful Offeror during the manufacture of the buses.

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

Materials furnished and Work performed by the successful Offeror shall conform to the requirements of the Technical Specifications and other Contract documents that may result from this RFP. Notwithstanding the provision of drawings, Technical Specifications or other data by the City, the successful Offeror shall have the responsibility of supplying all parts and details required to make the bus complete and ready for service even though such details may not be specifically mentioned in the drawings and specifications. Items that are installed by the City shall not be the responsibility of the successful Offeror unless they are included in the contract resulting from this RFP.

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

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

**GC 4.1 General**

The City shall at all times have access to the Work, the successful Offeror and, through the successful Offeror, its Suppliers. The successful Offeror and its Suppliers shall furnish every reasonable facility for ascertaining that the materials and the workmanship are in accordance with the requirements of the contract documents resulting from this RFP. All Work done shall be subject to the City's inspection and approval in accordance with the approved Work products developed as a result of the contract documents resulting from this RFP.

The pre-delivery tests and inspections shall be performed at the successful Offeror's plant; they shall be performed in accordance with the procedures defined in the "Quality Assurance" section of this Part 3, Scope of Services; and they may be witnessed by the resident inspector. When a bus passes these tests and inspections, the resident inspector shall authorize release of the bus.

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

**GC 4.2 Risk of Loss**

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

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

Adequate documents for registering the bus in Albuquerque, New Mexico shall be provided to the City not less than ten (10) business days before delivery to the City. Upon acceptance of each bus, the successful Offeror warrants that the title shall pass to the City free and clear of all encumbrances.

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

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

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

### **GC 7. Data Rights**

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

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

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

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

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

Notwithstanding any of the foregoing, the successful Offeror understands that the City is a governmental entity subject to the New Mexico Inspection of Public Records Act.

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

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

## ***GC 8. Supplements***

### **GC 8.1 Supplements**

Any change in the contract resulting from this RFP must be by mutual written agreement between the successful Offeror and the City. Oral change orders are not permitted.

## ***GC 9. Legal Clauses***

### **GC 9.1 Indemnification**

**GC 9.1.1** The successful Offeror shall: (1) protect, indemnify and save the City and its officers, employees and agents, including consultants, harmless from and against any and all liabilities, damages, claims, demands, liens, encumbrances, judgments, awards, losses, costs, expenses and suits or actions or proceedings, including reasonable expenses, costs and attorneys' fees incurred by the City and its officers, employees and agents, including consultants, in the defense, settlement or satisfaction thereof, for any injury, death, loss or damage to persons or property of any kind whatsoever, arising out of or resulting from the intentional misconduct or negligent acts, errors or omissions of the successful Offeror in the performance of the Contract, including intentional misconduct, negligent acts, errors or omissions of its officers, employees, servants, agents, Subcontractors and Suppliers; and (2) upon receipt of notice and if given authority, shall settle at its own expense or undertake at its own expense the defense of any such suit, action or proceeding, including appeals, against the City and its officers, employees and agents, including consultants, relating to such injury, death, loss or damage. Each party shall promptly notify the other in writing of the notice or assertion of such claim, demand, lien, encumbrance, judgment, award, suit, action or other proceeding hereunder.

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

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

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

**GC 9.2.3** The successful Offeror shall be allowed an equitable adjustment in the contract price (excluding profit) and/or an extension of the contract time, to the extent that cost or delays are shown by the successful Offeror to be directly attributable to any suspension. However, no adjustment shall be made under this section for any suspension, delay or

interruption due to the fault or negligence of the successful Offeror, or for which an equitable adjustment is provided for, or excluded under any other term or condition of the contract resulting from this RFP. As soon as reasonably possible but no later than forty-five (45) calendar days, or any other period of time agreed to by the parties, after receipt of the written suspension of work notice, the successful Offeror shall submit to the City a detailed price and schedule proposal for the suspension, delay or interruption.

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

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

- a. The cause of the delay arises after the Notice of Award and neither was nor could have been anticipated by the successful Offeror by reasonable investigation before such award. Such cause may also include force majeure events such as any event or circumstance beyond the reasonable control of the successful Offeror, including but not limited to acts of God; earthquake, flood and any other natural disaster; civil disturbance, strikes and labor disputes; fires and explosions; war and other hostilities; embargo; or failure of third parties, including Suppliers or Subcontractors, to perform their obligations to the successful Offeror;
- b. The successful Offeror demonstrates that the completion of the Work and/or any affected deliveries will be actually and necessarily delayed;
- c. The successful Offeror has taken measures to avoid and/or mitigate the delay by the exercise of all reasonable precautions, efforts and measures, whether before or after the occurrence of the cause of delay; and
- d. The successful Offeror makes written request and provides other information to the City as described in GC 9.3.4 below.

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

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

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

**GC 9.3.4** No extension or adjustment of time shall be granted unless: (1) written notice of the delay is filed with the City within fourteen (14) calendar days after the commencement of the delay and (2) a written application therefore, stating in reasonable detail the causes, the effect to date and the probable future effect on the performance of the successful Offeror under the Contract, and the



portion or portions of the Work affected, is filed by the successful Offeror with the City within thirty (30) calendar days after the commencement of the delay. No such extension or adjustment shall be deemed a waiver of the rights of either party under the contract resulting from this RFP. The City shall make its determination within thirty (30) calendar days after receipt of the application.

#### ***GC 9.4 Termination***

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

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

After receipt of a notice of termination, and except as otherwise directed by the City, the successful Offeror shall do the following:

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

- Take such action as may be necessary, or as the City may direct, for the protection or preservation of the property related to the contract resulting from this RFP that is in the possession of the successful Offeror and in which the City has or may acquire an interest.

#### **GC 9.4.2 Termination for Default**

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

If the contract resulting from this RFP is terminated in whole or in part for default, the City may procure, upon such terms and in such manner as the City may deem appropriate, supplies or services similar to those so terminated. The successful Offeror shall be liable to the City for any excess costs for such similar supplies or services, and shall continue the performance of the contract resulting from this RFP to the extent not terminated under the provisions of this clause.

Payment for completed supplies delivered to and accepted by the City shall be at the agreed upon contract price. The City may withhold from amounts otherwise due the successful Offeror for such completed supplies such sum as the City determines to be necessary to protect the City against loss because of outstanding liens or claims of former lien holders.

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

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

The successful Offeror shall at all times comply with all applicable laws, regulations, policies, procedures and directives (together, the "Law"), including without limitation, FTA regulations, policies, procedures and directives, including those listed directly or by reference in the agreement between the City and FTA that funds any part of the contract resulting from this RFP, as they may be amended or promulgated from time to time during the term of the contract resulting from this RFP. successful Offeror's failure to so comply shall constitute a material breach of the contract resulting from this RFP.

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

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

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

The contract resulting from this RFP shall be governed by the laws of New Mexico without regard to conflict of law rules. The successful Offeror consents to the jurisdiction of the identified State, County of Bernalillo.

### ***G 9.8 Disputes***

a. Notice of Potential Claim. With respect to disputes arising under the contract resulting from this RFP, the Offeror have no right to additional compensation for any claim that may be based on any act, failure to act, event, thing, or occurrence for which no written notice of potential claim has been filed with the City. The written notice of potential claim shall set forth the reasons for which the successful Offeror believes additional compensation will or may be due, the nature of the costs involved, and, insofar as possible, the amount of the potential claim. The notice must be received by the City within party within 10 (ten) calendar days of the determination of the dispute. The Offeror shall have no right to additional compensation for any claim that may be based on any such act, failure to act, event, thing, or occurrence for which no written notice of potential claim as herein required was filed.

b. Negotiation. The parties shall attempt in good faith to resolve any dispute arising out of or relating to the contract resulting from this RFP promptly by negotiation. Within thirty (30) days after receipt of the claim notice, both parties shall meet at a mutually acceptable time and place in an attempt to resolve the dispute.

c. Decision by Chief Procurement Officer. Any dispute concerning a question of fact arising during the performance of the contract resulting from this RFP which is not disposed of by negotiation will be decided by Chief Procurement Officer who will reduce the decision to writing and mail or otherwise furnish a copy thereof to the successful Offeror. The decision of the Chief Procurement Officer will be final and binding unless, within thirty (30) days from the date of issuance of the Chief Procurement Officer's final decision, the Contractor notifies the City in writing of the successful Offeror's disagreement with the final decision.

d. Mediation and Arbitration.

i. Upon receipt of the successful Offeror's written notice of claim under subsection a, the parties shall mediate the dispute by mediation. Each party shall provide the other with a list of four (4) mediators. The parties shall confer on the lists and select a mutually agreeable mediator from the lists or other agreeable source. Mediation shall consist of an informal, non-binding conference or conferences between the parties and the mediator jointly, then in separate caucuses wherein the mediator will seek to guide the parties to a resolution of the case. All conferences shall take place within fifty (50) miles of Albuquerque, New Mexico. All mediation proceedings shall be without prejudice and the cost of the proceedings shall be shared equally by the parties. The mediation process shall continue until the case is resolved or until such time as the mediator makes a finding that there is no possibility of resolution, then the mediation will be terminated and each party may pursue all remedies available to it at law or in equity except as specifically limited elsewhere in the contract resulting from this RFP.

ii. If the parties mutually agree, any dispute or claim in law or equity between the City and the successful Offeror, arising out of the contract resulting from this RFP which is not settled through mediation shall be decided by neutral binding arbitration and not by court action, except as provided by New



Mexico law for judicial review of arbitration proceedings. The parties to arbitration may agree in writing to use different rules and/or arbitrators.

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

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

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

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

***GC 9.10 Confidential Information***

Access to government records is governed by the New Mexico Inspection of Public Records Act (Sections 14-2-1 et seq, NMSA 1978). Except as otherwise required by the New Mexico State law, the City will exempt from disclosure proprietary information, trade secrets and confidential commercial and financial information submitted or disclosed during the contract period. Any such proprietary information, trade secrets or confidential commercial and financial information that a successful Offeror believes should be

exempted from disclosure shall be specifically identified and marked as such. Blanket-type identification by designating whole pages or sections as containing proprietary information, trade secrets or confidential commercial and financial information will not ensure confidentiality. The specific proprietary information, trade secrets or confidential commercial and financial information must be clearly identified as such.

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

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

***GC 9.12 General Nondiscrimination Clause***

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

***GC 9.13 Amendments and Waivers***

***GC 9.13.1 Amendment***

Any modification or amendment of any provisions of any of the contract resulting from this RFP shall be effective only if in writing, signed by authorized representatives of both the City and successful Offeror, and specifically referencing the contract resulting from this RFP.

***GC 9.13.2 Waiver***

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

***GC 9.14 Third-Party Beneficiaries***

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

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## **PART 3.2 - SPECIAL PROVISIONS (SP) TO THE CONTRACT RESULTING FROM THIS RFP**

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

#### **SP 1.1. Pilot Bus**

The successful Offeror shall produce one pilot vehicle for the base order. This vehicle shall be one of the ultimate quantity of the base vehicle order. The pilot vehicle shall demonstrate that the vehicles fully meet all requirements of the Contract resulting from this RFP.

The City will inspect the pilot bus while it is under construction at the factory. The Offeror shall provide the City with a timeline for the construction with sufficient forewarning so that the City can timely schedule and make arrangements to inspect the pilot bus prior to the interior panels being installed. The items of particular interest to the City during this inspection are: the compressed air lines and system, electrical conduits, and the electrical wiring. If these are not installed or visible for inspection when the City staff arrive as scheduled in advance, the Offeror shall reimburse the City for its staff travel expenses.

The pilot vehicle shall be produced and delivered to the City no later than February 13, 2017, for a minimum of thirty (30) days prior to initiation of any production activities for the remaining vehicles unless otherwise authorized in writing by the City. In the event that noncompliance is identified, the City shall to the extent practicable notify the successful Offeror of said noncompliance. No later than seven (7) days after the end of the 30-day test, the City shall issue a written report to the successful Offeror that advises the successful Offeror of any noncompliance issues and/or any proposed modifications or changes required on the remaining vehicles.

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

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

In order to assess the successful Offeror's compliance with the Technical Specifications, the City and the successful Offeror shall, at the Pre-Production Meeting, jointly develop a configuration and performance review document for review of the pilot vehicle. This document shall include appropriate performance standards for each test that is being required and the document shall become part of the official record of the pre-production meeting.

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

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

Where required by the Contract resulting from this RFP or requested by the City, the successful Offeror shall cause first article inspections to be conducted. A first article inspection may include both a physical configuration inspection and a functional demonstration. First article inspections shall be conducted at the successful Offeror or Subcontractor's facility. The successful Offeror shall

furnish to the City prior to each first article inspection a written inspection and demonstration plan for each item for review. The City will attend each first article inspection unless the City provides a written waiver of its right to attend any such inspection. The results of each first article inspection shall be documented by the successful Offeror in a format deemed acceptable by the City, and all documents relating to the inspection shall be forwarded to the City.

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

The City will conduct acceptance tests on each delivered bus. These tests shall be completed within fifteen (15) days after bus delivery and shall be conducted in accordance with written test plans. The purpose of these tests is to identify Defects that have become apparent between the time of bus release and delivery to the City. The post-delivery tests shall include visual inspection and bus operations. No post-delivery test shall apply criteria that are different from the criteria applied in an analogous pre-delivery test (if any).

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

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

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

#### ***SP 1.6 Repair Performance***

##### **SP 1.6.1 Repairs by successful Offeror**

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

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

##### **SP 1.6.2 Repairs by the City**

The City will not take responsibility to correct Defects, except to replace defective parts as instructed by the successful Offeror.

1. **Parts used.** If the City performs the repairs after non-acceptance of the bus, it shall correct or repair the Defect and any Related Defects using successful Offeror-specified parts available from its own stock or those supplied by the successful Offeror specifically for this repair. Reports of all repairs covered by this procedure shall be submitted by the City to the successful Offeror for reimbursement or replacement of parts monthly, or at a period to be mutually agreed upon. The successful Offeror shall provide forms for these reports.



2. **Successful Offeror-supplied parts.** If the successful Offeror supplies parts for repairs being performed by the City after non-acceptance of the bus, these parts shall be shipped prepaid to the City.
3. **Return of defective components.** The successful Offeror may request that parts covered by this provision be returned to the manufacturing plant. The total costs for this action shall be paid by the successful Offeror.
4. **Reimbursement for labor.** The City shall be reimbursed by the successful Offeror for labor. The amount shall be determined by the City for a qualified mechanic at a straight time wage rate of \$65.00 per hour, which includes fringe benefits and overhead adjusted for the City's most recently published rate in effect at the time the Work is performed, plus the cost of towing in the bus, if such action was necessary. These wage and fringe benefits rates shall not exceed the rates in effect in the City's service garage at the time the Defect correction is made.
5. **Reimbursement for parts.** The City shall be reimbursed by the successful Offeror for defective parts that must be replaced to correct the Defect. The reimbursement shall include taxes where applicable and fifteen (15) percent handling costs.

## **SP2. Deliveries**

### **SP 2.1 Bus Delivery**

Delivery of buses shall be determined by signed receipt of the City's designated agent(s), **City of Albuquerque – ABQ Ride, 100 First Street SW, Albuquerque, NM 87102**, at the following point of delivery and may be preceded by a cursory inspection of the bus: 8001 Daytona Rd. NW, Albuquerque, NM 87121.

### **SP 2.2 Delivery Schedule**

The pilot vehicle shall be delivered to the City on February 13, 2017. The buses shall be delivered at a rate not to less than three (3) buses per week. After the Pilot Bus, delivery shall commence no later than May 8, 2017 (sooner than 52 weeks after delivery of the executed contract documents.) with the last of the 18 buses delivered by 6/17/17. Hours of delivery shall be 8:00 a.m. to 4:00 p.m. on the following days of the week: Monday through Friday.

### **SP 2.3 Contract Deliverables**

Contract deliverables associated with the Contract resulting from this RFP are set forth in the table below, along with other pertinent information. Contract deliverables shall be submitted in accordance with Section 3.4 of this Part 3, Technical Specifications. Due dates shown note the last acceptable date for receipt of Contract deliverables. The City will consider early receipt of contract deliverables on a case-by-case basis. The reference section designates the appropriate specification section(s) where the requirement is referenced.

**TABLE 1**  
**Contract Deliverables**

Deliverable	City Action	Reference Section	Due Date	Format	Quantity Due
1. Bus Testing — Altoona Test Report	Review		Prior to pilot bus delivery	Hardcopy	1
2. List of serialized units installed on each bus	Review		With each delivered bus	Electronic Media	1 per bus

**TABLE 1**  
**Contract Deliverables**

Deliverable	City Action	Reference Section	Due Date	Format	Quantity Due
3. Copy of Manufacturers formal Quality Assurance Program	Review		Pre-award site visit	Hardcopy	1
4. QA manufacturing certificate	Review		With each delivered bus	Hardcopy	1 per bus
5. QA purchasing certifications acknowledging receipt of applicable specification	Review		30 days following first pre-production meeting	Hardcopy	1 per major Supplier
6. Pre-Delivery Bus Documentation Package	Review		With each delivered bus	Hardcopy	1 per bus
7. Motor Vehicle Pollution Requirements Certificate	Review		With each bus	Hardcopy	1
8. Engine Emissions Certificate — NOx levels	Review		Prior to completion of pilot bus	Hardcopy	1
9. Pre-production meeting minutes	Approval		30 days after each meeting	Hardcopy	2 originals
10. Driver's log and incident report	Review		With each bus delivery if drive away service is used	Hardcopy	1 per bus
11. Title documentation	Review		10 days prior to bus delivery	Hardcopy	1 per bus
12. Performance bond	Review		30 days following execution of Contract	Hardcopy	1
13. Insurance certificates	Approval		Before Work commences	Hardcopy	1
14. Engineering support	Review		During pre-production meeting	Contracts	1
15. Training instructor information	Approval		30 days prior to delivery of pilot bus		
16. Training curriculum	Approval		30 days prior to delivery of pilot bus	Electronic Media	
17. Teaching materials	Review		During classroom instruction	Hardcopy	1

**TABLE 1**  
**Contract Deliverables**

Deliverable		City Action	Reference Section	Due Date	Format	Quantity Due
18.	Professionally prepared mechanics' "Bus Orientation" training video	Review		30 days prior to first production bus	Electronic Media	20 each
19.	Final preventative maintenance manuals	Review		90 days after City written approval	Hardcopy Electronic Media	10/100 buses 20
20.	Final diagnostic procedures manuals	Review		90 days after City written approval	Hardcopy Electronic Media	10/100 buses 20
21.	Final parts manuals	Approval		90 days after City written approval	Hardcopy Electronic Media	10/100 buses 20
22.	Component repair manuals (City approval/review period of 90 days from date of receipt)	Approval		90 days after City written approval of OEM component repair list	Hardcopy Electronic Media	2 2
23.	Draft preventative maintenance manuals (City approval/review period of 90 days from date of receipt)	Approval		With pilot bus	Hardcopy	10
24.	Draft diagnostic procedures manuals (City approval/review period of 90 days from date of receipt)	Approval		With pilot bus	Hardcopy	10
25.	Draft parts manuals. (City approval/review period of 90 days from date of receipt)	Approval		With pilot bus	Hardcopy	10
26.	List of OEM component repair manuals	Approval		With pilot bus	Hardcopy	10



**TABLE 1**  
**Contract Deliverables**

Deliverable	City Action	Reference Section	Due Date	Format	Quantity Due
27. Draft operators' manuals (City approval/review period of 90 days from date of receipt)	Approval		With pilot bus or maximum of 30 days prior to start of production	Hardcopy	10
28. Final operators' manuals	Review		30 days following City approval of draft manual	Hardcopy	1 per bus
29. Recommended spare parts list, including bill of materials	Review		60 days prior to shipment of first bus	Hardcopy	1
30. Part number index	Approval		60 days prior to shipment of first bus	Hardcopy Spreadsheet	1 1
31. Current price list	Review		90 days after City written approval of draft parts manual	Hardcopy	20
32. In-process drawings	Review		30 days prior to production	Scale drawings	1
33. Electrical and air schematics	Review		30 days prior to production	Hardcopy	1
34. As-built drawings	Review		Within 60 days after final bus delivery	Electronic Media	1
35. Material samples	Review		By conclusion of pre-production meetings		1
36. Undercoating system program	Approval		First pre-production meeting	Hardcopy	1
37. Flooring certificate	Review		First pre-production meeting	Certificate/copy of purchase order	1
38. Interior features – fire-resistance certificates	Review		Prior to pilot bus completion	Certificates	1
39. Crashworthiness	Review		Pre-award audit	Certificate	1
40. Technical review of electronic functionality	Approval		Prior to production	Hardcopy	1

**TABLE 1**  
**Contract Deliverables**

Deliverable	City Action	Reference Section	Due Date	Format	Quantity Due
41. Interior security camera layout	Approval		Prior to pilot bus completion	Copies of interior views	1 each
42. Technical review of powerplant			Prior to production		
43. Powerplant certifications	Review		Prior to pilot bus completion	Hardcopy	1 each
44. Striping layout	Approval		Prior to production	Hardcopy	1
45. Resolution of issues "subject to City approval"	Approval		Prior to production	Hardcopy	1

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

The successful Offeror hereby grants the City and any permissible assignee options ("Options") to purchase up to Twelve (12) additional vehicles ("Option Vehicles"). The Options shall be valid for up to a five (5) years from the effective date of the Contract resulting from this RFP. There shall be no minimum order quantity for any permissible assignee. Subject to the City's right to order modifications, the Option Vehicles shall have the same specifications as the vehicles purchased under the Contract resulting from this RFP. The City may exercise the Options by written notice to the successful Offeror ("Notice of Exercise of Option") at any time on or before five years following the effective date of the Contract resulting from this RFP ("Option Date").

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

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

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

Within thirty (30) days after delivery of the Notice of Exercise of Option to the successful Offeror, the successful Offeror shall submit a proposed delivery schedule. Along with the proposed delivery schedule, the successful Offeror will provide the City with access to its production schedule for the purpose of the parties verifying available production capacity. The production schedule shall include a reasonable time for mobilization and for coordinating with other vehicle orders, and it shall be based upon a production rate at least equal to the production rate actually realized with respect to the base order vehicles. If the parties are

unable to agree on a production schedule, the maximum term for the production of the Option Vehicles shall not exceed a total of twelve (12) months after the date of Notice to Proceed with Option Vehicle production. The City or any permissible assignee may issue a Notice to Proceed at any time after the successful Offeror submits its proposed delivery schedule. The successful Offeror shall not commence production of the Option Vehicles prior to issuance of the Notice to Proceed by the City or any permissible assignee of the City for the Option Vehicles incorporating the agreed production delivery schedule or the twelve (12)-month maximum term.

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

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

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

***SP 5. Payment***

The City shall pay and the successful Offeror shall accept the amounts set forth in the Pricing Schedule as full compensation for all costs and expenses of completing the Work in accordance with the Contract resulting from this RFP.

**SP 5.1 Payment Terms - Payment Upon Delivery**

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

The City shall make payments for buses at the unit prices itemized in the Pricing Schedule within thirty (30) calendar days after the delivery and acceptance of each bus, receipt of a proper invoice and title of origin.

The City shall make payments for spare parts and/or equipment at the unit prices itemized in the Pricing Schedule within thirty (30) calendar days after the delivery and acceptance of said spare parts and/or equipment and receipt of a proper invoice.

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

1. Delivery and acceptance of all contract deliverables, including manuals and other documentation required by the Contract resulting from this RFP, excluding training.
2. Successful Offeror's provision of any certifications as required by law and/or regulations.
3. Completion of post-delivery audits required under the Contract resulting from this RFP.

**SP 5.2 Payment of Taxes**

Unless otherwise provided in the Contract resulting from this RFP, the successful Offeror shall pay all federal, state and local taxes, and duties applicable to and assessable against any Work, goods, services, processes and operations incidental to or involved in the Contract resulting from this RFP, including but not limited to retail sales and use, transportation, export, import, business and special taxes. The successful Offeror is responsible for ascertaining and paying the taxes when due. The

total Contract price shall include compensation for all taxes the successful Offeror is required to pay by laws in effect on the Proposal due date. The successful Offeror will maintain auditable records, subject to the City reviews, confirming that tax payments are current at all times.

***SP 6 Liquidated Damages for Late Delivery of the Bus***

**SP 6.1** It is mutually understood and agreed by and between the parties to the contract resulting from this RFP that time is of the essence with respect to the completion of the Work and that in case of any failure on the part of the Offeror to deliver the buses within the time specified in "Delivery Schedule," except for any excusable delays as provided in "Excusable Delays/Force Majeure" or any extension thereof, the City will be damaged thereby. Because the amount of said damages are difficult if not impossible of definite ascertainment and proof, the Offeror agrees that the amount of such damages due to the City shall be fixed at Two Hundred Seventy-Five Dollars (\$275) per calendar day per bus not delivered in substantially good condition as inspected by the City at the time released for shipment.

**SP 6.2** The Offeror hereby agrees to pay the aforementioned amounts as fixed, agreed and liquidated damages, and not by way of penalty, to the City and further authorizes the City to deduct the amount of the damages from money due the Offeror under the Contract resulting from this RFP, computed as aforesaid. If the money due the Offeror is insufficient or no money is due the Offeror, then the Offeror shall pay the City the difference or the entire amount, whichever may be the case, within thirty (30) days after receipt of a written demand by the Contracting Officer.

**SP 6.3** The payment of aforesaid fixed, agreed and liquidated damages shall be in lieu of any damages for any loss of profit, loss of revenue, loss of use, or for any other direct, indirect, special or consequential losses or damages of any kind whatsoever that may be suffered by the City arising at any time from the failure of the Offeror to fulfill the obligations referenced in this clause in a timely manner.

***SP 7 Service and Parts***

**SP 7.1 Successful Offeror Service and Parts Support**

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

**SP 7.2 Documentation**

The successful Offeror shall provide current maintenance manual(s) to include preventative maintenance procedures, diagnostic procedures or trouble-shooting guides and major component service manuals, four (4) electronic current parts manual(s), and four (4) electronic standard operator's manual(s) as part of the Contract resulting from this RFP. The successful Offeror also shall exert its best efforts to keep maintenance manuals, operator manuals and parts books up to date for a period of fifteen (15) years. The supplied manuals shall incorporate all equipment ordered on the buses covered by this procurement. In instances where copyright restrictions or other considerations prevent the successful Offeror from incorporating major components information into the bus parts and service manuals, separate manual sets as published by the subcomponent Supplier will be provided.

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

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

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

Where the successful Offeror fails to honor this parts guarantee or parts ordered by the City are not received within thirty (30) days of the agreed-upon delivery date, then the successful Offeror shall provide to City, within seven (7) days of the City's verbal or written request, the design and manufacturing documentation for those parts manufactured by the successful Offeror and the original Suppliers' and/or manufacturers' parts numbers, company names, addresses, telephone numbers and contact persons' names for all of the specific parts not received by the City. The successful Offeror's design and manufacturing documentation provided to the City shall be for its sole use in regard to the buses procured under the Contract resulting from this RFP and for no other purpose.

### **SP 7.4 City-Furnished Property**

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

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

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

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



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

The successful Offeror shall submit one (1) manufacturer's FMVSS self-certification, Federal Motor Vehicles Safety Standards, that the vehicle complies with relevant FMVSS or two manufacturer's certified statement that the contracted buses will not be subject to FMVSS regulations.

***SP 9. Sustainability***

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

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## **SECTION 3.3 FEDERAL REQUIREMENTS**

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

The successful Offeror agrees to maintain all books, records, accounts and reports required under the Contract resulting from this RFP for a period of not less than three years after the date of termination or expiration of the Contract resulting from this RFP, except in the event of litigation or settlement of claims arising from the performance of the Contract resulting from this RFP, in which case successful Offeror agrees to maintain same until the City, 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 the Contract resulting from this RFP:

#### **FR 5.1.1 Local Governments**

In accordance with 49 CFR 18.36(i), the successful Offeror agrees to provide the City, 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 successful Offeror that are directly pertinent to the Contract resulting from this RFP for the purposes of making audits, examinations, excerpts and transcriptions. successful Offeror also agrees, pursuant to 49 CFR 633.17 to provide the FTA Administrator or his authorized representatives including any PMO contractor access to successful Offeror'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 5.1.2 State Governments**

In accordance with 49 CFR 633.17, the successful Offeror agrees to provide the City, the FTA Administrator or his authorized representatives, including any PMO contractor, access to the successful Offeror'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 successful Offeror 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 to be included in the contract resulting from this RFP, whether or not expressly set forth in the preceding provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1F or its successors are hereby incorporated into the contract resulting from this RFP 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 the contract resulting from this RFP. The successful Offeror shall not perform any act, fail to perform any act or refuse to comply with any City requests that would cause the City to be in violation of the FTA terms and conditions.

The successful Offeror 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 City and FTA, as they may be amended or promulgated from time to time during the term of the Contract resulting from this RFP. successful Offeror's failure to so comply shall constitute a material breach of the Contract resulting from this RFP.



**FR 3. Federal Energy Conservation Requirements**

The successful Offeror 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 contract resulting from this RFP:

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 successful Offeror 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 successful Offeror 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 successful Offeror 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 successful Offeror 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 successful Offeror 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 successful Offeror agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the successful Offeror 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 successful Offeror 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 successful Offeror agrees to comply with any implementing requirements FTA may issue.

3. The successful Offeror 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 City and successful Offeror acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of this RFP or award of the contract resulting from this RFP, absent the express written consent by the Federal Government, the Federal Government is not a party to the contract resulting from this RFP and shall not be subject to any obligations or liabilities to the City, successful Offeror, or any other party (whether or not a party to that Contract) pertaining to any matter resulting from the contract resulting from this RFP.
2. The successful Offeror 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 successful Offeror 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 the contract resulting from this RFP. Upon execution of the contract resulting from this RFP, the successful Offeror 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 contract resulting from this RFP or the FTA assisted project for which the contract resulting from this RFP Work is being performed. In addition to other penalties that may be applicable, the successful Offeror 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 successful Offeror to the extent the Federal Government deems appropriate.
2. The successful Offeror 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 successful Offeror, to the extent the Federal Government deems appropriate.
3. The successful Offeror 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**

The contract resulting from this RFP is a covered transaction for purposes of 49 CFR Part 29. As such, the successful Offeror is required to verify that none of the successful Offeror, 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 successful Offeror 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, Offeror certifies as follows:

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

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

The contract resulting from this RFP 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 successful Offeror shall maintain compliance with “DBE Approval Certification” throughout the period of contract performance.

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

**FR 9. Clean Water Requirements**

1. The successful Offeror 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 successful Offeror agrees to report each violation to the City and understands and agrees that the City will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.
2. The successful Offeror 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 successful Offeror 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 successful Offeror agrees to report each violation to the City and understands and agrees that the City

will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office.

2. The successful Offeror 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***

Successful Offerors 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 City, 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.

***FR12. Buy America***

The successful Offeror 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.

The Offeror must submit to the City the appropriate Buy America Certification with all Proposals 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 successful Offeror 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 successful Offeror 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 successful Offeror 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 RFP specification requirements: The successful Offeror shall submit evidence that it will be capable of meeting the RFP requirements.
- 3 Federal Motor Vehicle Safety Standards (FMVSS): The successful Offeror 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 successful Offeror agrees to the following:

1. To use privately owned U.S.-flag commercial vessels to ship at least fifty (50) percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners and tankers) involved, whenever shipping any equipment, material or commodities pursuant to the contract resulting from this RFP to the extent such vessels are available at fair and reasonable rates for U.S.-flag commercial vessels;
2. To furnish within twenty (20) working days following the date of loading for shipments originating within the United States or within thirty (30) working days following the date of 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 successful Offeror in the case of a Subcontractor's bill-of-lading.)
3. To include these requirements in all subcontracts issued pursuant to the contract resulting from this RFP when the subcontract may involve the transport of equipment, material or commodities by ocean vessel.

**FR 16. Fly America**

The successful Offeror 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 successful Offeror 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 successful Offeror agrees to include the requirements of this section in all subcontracts that may involve international air transportation.

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

1. **Overtime requirements:** No successful Offeror or Subcontractor contracting for any part of the Contract resulting from this RFP Work that may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any work week in which he or she is employed on such Work to work in excess of 40 hours in such work week unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.
2. **Violation; liability for unpaid wages; liquidated damages:** In the event of any violation of the clause set forth in paragraph 1 of this section, the successful Offeror and any Subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such successful Offeror 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 work week of 40 hours without payment of the overtime wages required by the clause set forth in paragraph 1 of this section.
3. **Withholding for unpaid wages and liquidated damages:** The City shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the successful Offeror or Subcontractor under any such contract or any other Federal contract with the same Prime successful Offeror, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same Prime successful Offeror, such sums as may be determined to be necessary to satisfy any liabilities of such successful Offeror or Subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 of this section.
4. **Subcontracts:** The successful Offeror or Subcontractor shall insert in any subcontracts the clauses set forth in paragraphs 1 through 4 of this section and also a clause requiring the Subcontractors to include these clauses in any lower tier subcontracts. The Prime successful Offeror shall be responsible for compliance by any Subcontractor or lower-tier Subcontractor with the clauses set forth in paragraphs 1 through 4 of this section.

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**SECTION 3.4: TECHNICAL SPECIFICATIONS: CLEAN DIESEL BUS****GENERAL*****TSD 1.Scope***

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

***TSD 2. Definitions***

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

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

**Analog Signals.** A 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).** Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.

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

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

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

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

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

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

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

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

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

**Code.** A legal requirement.

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

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

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

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

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

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

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

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

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

**DC to DC Converter.** A module which converts a source of direct current (DC) from one voltage level to another.

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

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

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

**Destroyed.** Physically made permanently unusable.

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

**DPF.** Diesel particulate filter.

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

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

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

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

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

**Energy Storage System (ESS).** A component or system of components that stores energy and for which its supply of energy is rechargeable by a PPU and/or an off-vehicle energy source.

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

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

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

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

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

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

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

**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.

**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 sq. ft. shall be allocated for the feet of each seated passenger that protrudes into the standee area.

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

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

**Gross Battery Capacity.** Gross capacity would be measured in kWh and would be the energy available from the entire battery pack.

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

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

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

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

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

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

**Hose:** Flexible line.

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

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

**Hybrid Drive System (HDS).** The mechanical and/or electromechanical components, including the PPU and energy storage system, which comprise the traction drive portion of the hybrid propulsion system.

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



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

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

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

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

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

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

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

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

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

**Local Regulations.** Regulations below the state level.

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

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

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

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

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

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

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

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

**Module.** Assembly of individual components

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

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

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

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

**Pipe:** Nonflexible line.

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

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

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

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

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

**Real-Time Clock (RTC).** Computer clock that keeps track of the current time.

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

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

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

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

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

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



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

**NOTE:** An example is the communication that takes place between two or more electronic components with the ability to process and store information.

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

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

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

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

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

**Special Tools.** Tools not normally stocked by the City.

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

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

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

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

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

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

**State of Charge (SOC).** Quantity of electric energy remaining in the battery relative to the maximum rated Amp hour (Ah) capacity of the battery expressed in percent. This is a dynamic measurement used for the energy storage system. A full SOC indicates that the energy storage system cannot accept further charging from the engine driven generator or the regenerative braking system. An absolute SOC is based on total battery capacity at the beginning of useful life. A relative SOC is based on total degraded capacity at the time of measurement. The actual relationship between the SOC and energy stored expressed as a percentage shall be linear.

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

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

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

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

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

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

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

### ***TSD 3. Referenced Publications***

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

### ***TSD 4. Legal Requirements***

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

Buses shall meet all applicable FMVSS and shall accommodate all applicable FMCSR regulations in effect at location of the City and the date of manufacture.

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

### ***TSD 5. Overall Requirements***

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

#### **TSD 5.1 Weight**

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

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

#### **TSD 5.2 Capacity**

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

#### **TSD 5.3 Service Life**

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

#### **TSD 5.4 Maintenance and Inspection**

Scheduled maintenance tasks shall be related and shall be, in accordance with the manufacturer's recommended preventative maintenance schedule (along with routine daily service performed during the fueling operations).

Test ports, as required, shall be provided for commonly checked functions on the bus, such as air intake, exhaust, hydraulic, pneumatic, charge-air and engine cooling systems.

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

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

The successful Offeror shall provide a list of all special tools and pricing required for maintaining this equipment. Said list shall be submitted as a supplement to the Pricing Schedule.

**NOTE:** Tools such as compartment door keys, bellows gauges and other tools that are required for daily maintenance and inspections shall not be included in the special tool list and shall be furnished for each coach.

### **TSD 5.5 Interchangeability**

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

Any one component or unit used in the construction of these buses shall be an exact duplicate in design, manufacture and assembly for each bus in each order group in the contract resulting from this RFP. The successful Offeror shall identify and secure approval for any changes in components or unit construction provided within the contract resulting from this RFP.

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

The City shall review proposed product changes on a case-by-case basis and shall have the right to require extended warranties to ensure that product changes perform as least as well as the originally supplied products.

### **TSD 5.6 Training**

The successful Offeror shall have at least one qualified instructor who shall be available at the City's property for five (5) calendar days between the hours of 8:00 a.m. and 5:00 p.m. per month for one (1) month prior to, and up to eighteen (18) months after, acceptance of the first bus. The total hours of instruction shall not exceed 120 hours. Instructor(s) shall conduct schools and advise the personnel of the City on the proper operation and maintenance of the equipment. The successful Offeror also shall provide visual and other teaching aids (such as manuals, slide presentations and literature) for use by the City's own training staff and which become the property of the City.

### **Technical/Service Representatives**

The successful Offeror shall, at its own expense, have one or more competent technical service representatives available on request to assist the City 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 successful Offeror of responsibilities under the provisions of "Section 7: Warranty Requirements."

### **TSD 5.7 Operating Environment**

The bus shall achieve normal operation in ambient temperature ranges of 10 °F to 115 °F, at relative humidity between 5 percent and 100 percent, and at altitudes up to 3000 feet above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F or at altitudes above 3000 feet. Altitude requirements above 3000 feet will need separate discussions with the engine manufacturer to ensure that performance requirements



are not compromised. Speed, gradability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 in. Hg, dry air per SAE J1995.

#### **TSD 5.8 Noise**

##### **Interior Noise**

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

The bus-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 80 dBA. The driver area shall not experience a noise level of more than 75 dBA.

An exception shall be made for the turntable area, which shall be considered a separate environment.

##### **Exterior Noise**

Airborne noise generated by the bus and measured from either side shall not exceed 80 dBA under full power acceleration when operated 0 to 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dBA. The bus-generated noise at curb idle shall not exceed 65 dBA. If the noise contains an audible discrete frequency, a penalty of 5 dBA shall be added to the sound level measured. The Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by the City and SAE J366.

#### **TSD 5.9 Fire Safety**

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

#### **TSD 5.10 Respect for the Environment**

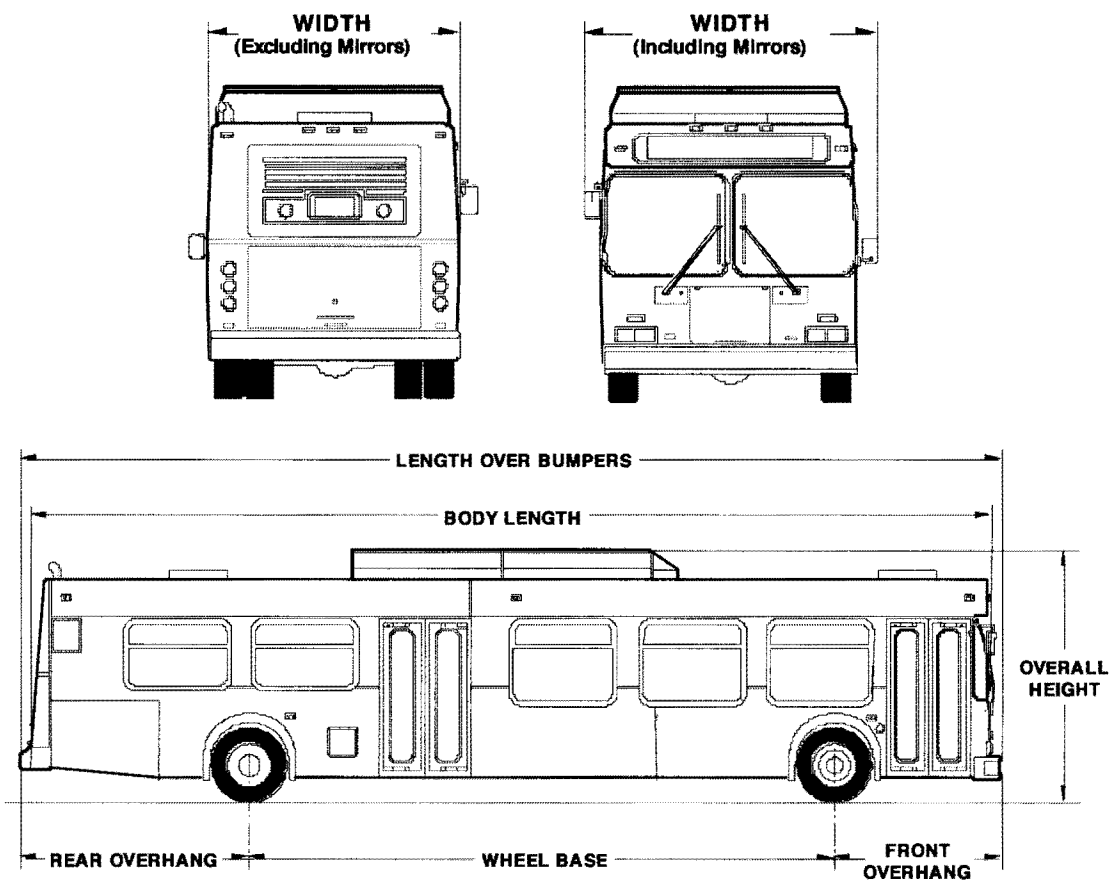
In the design and manufacture of the bus, the Contractor shall make every effort to reduce the amount of potentially hazardous waste. In accordance with Section 6002 of the Resource Conservation and Recovery Act, the Contractor shall use, whenever possible and allowed by the specifications, recycled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

## DIMENSIONS

### ***TSD 6. Physical Size***

With exceptions such as exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers, ad frames, cameras, object detection systems, bicycle storage, feelers and rub rails, the bus shall have the following overall dimensions as shown in Figure 1 at static conditions and design height.

**FIGURE 1**  
Transit Bus Exterior Dimensions



### **TSD 6.1 Bus Length**

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

- **60-ft BRT bus:** 60 ft. to 64 ft.

### **TSD 6.2 Bus Width**

102-in. Width Bus

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

### **TSD 6.3 Bus Height**

Maximum overall height shall be 133 in., including all rigid, roof-mounted items such as A/C, exhaust, fuel system and cover, etc.



**TSD 6.4 Height at Top of the Floor Center Isle all Doors**

The height of the top of the floor at all doors shall be 15.5 inches +/- 0.125 inches, to be equal to the height of all station platforms.

**TSD 6.5 Underbody Clearance**

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

**TSD 6.6 Ramp Clearances**

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

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

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

Angle	60-ft Bus
Approach	9 degrees (min.)
Front breakover	10.2 degrees (min.)
Rear breakover (articulated only)	8.7 degrees (min.)
Departure	9 degrees (min.)

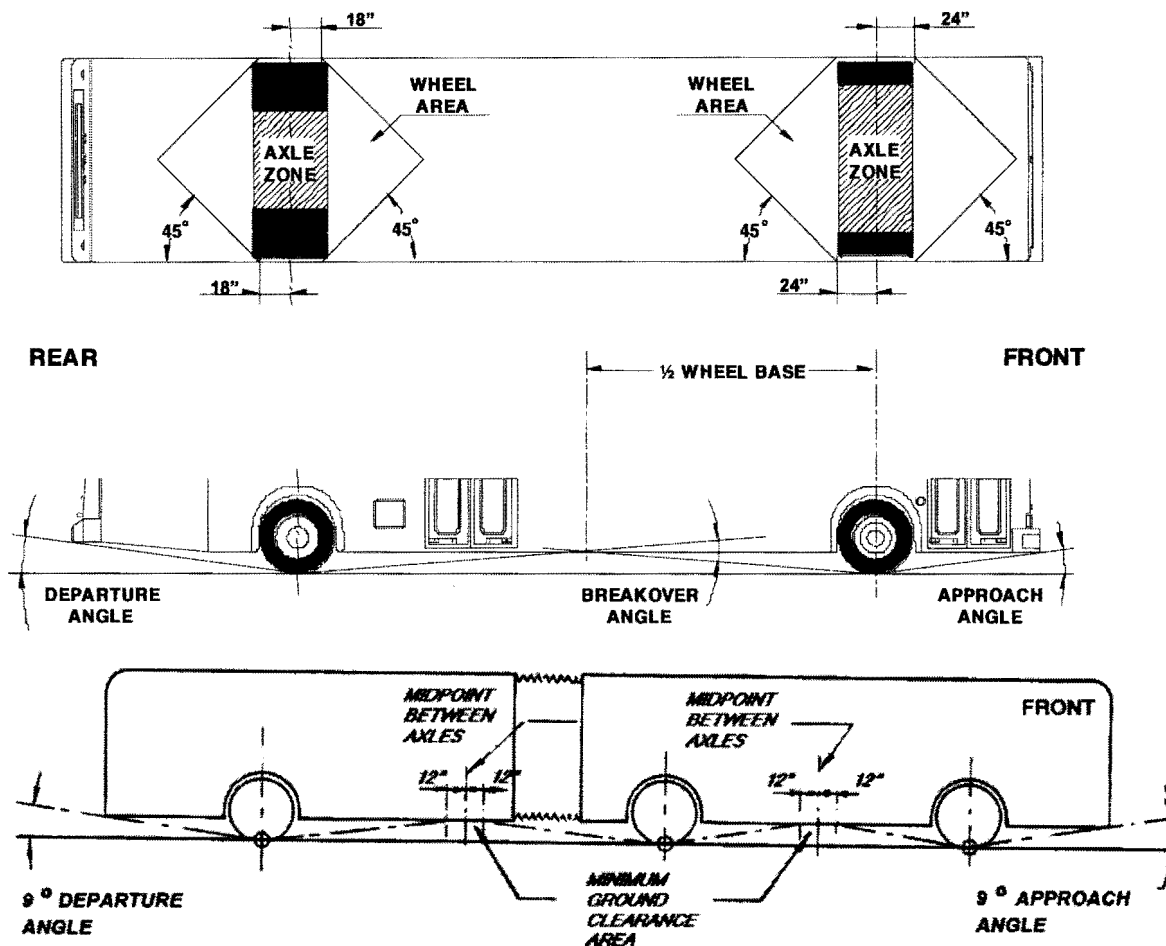
**TSD 6.7 Ground Clearance**

Ground clearance shall be no less than 8 in.) except within the axle zone and wheel area.

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

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

**FIGURE 2**  
Transit Bus Minimum Road Clearance



### TSD 6.8 Floor Height

Height of the step above the street shall be 15.5 in., +/- 0.25 inches measured at the centerline of the doorways. The floor may be inclined along the longitudinal axis of the bus, and the incline shall not exceed 2 degrees off the horizontal except locally at the doors where 2 degree slope toward the door is allowed. All floor measurements shall be with the bus at the design running height and on a level surface and with the standard installed tires. A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus.

### TSD 6.9 Interior Headroom

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

**TSD 6.10 Aisle Width**

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

**VEHICLE PERFORMANCE*****TSD 7. Power Requirements***

The propulsion system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed, and gradability requirements, and operate all propulsion-driven accessories using actual road test results and computerized vehicle performance data.

**TSD 7.1 Top Speed**

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

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply City with data if there is a variance between peak performance and sustained vehicle performance.

**TSD 7.2 Gradability**

Gradability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating. The propulsion system and drivetrain shall enable the bus to achieve and maintain a speed of 40 mph on a 2½ percent ascending grade and 15 mph on a 10 percent ascending grade continuous.

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply City with data if there is a variance between peak performance and sustained vehicle performance.

**TSD 7.3 Acceleration**

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

**TABLE 3**  
Maximum Start Acceleration Times on a Level Surface<sup>1</sup>

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

1. Vehicle weight = GVWR

**TSD 7.4 Operating Range**

The operating range of the coach shall be designed to meet the operating profile as follows:

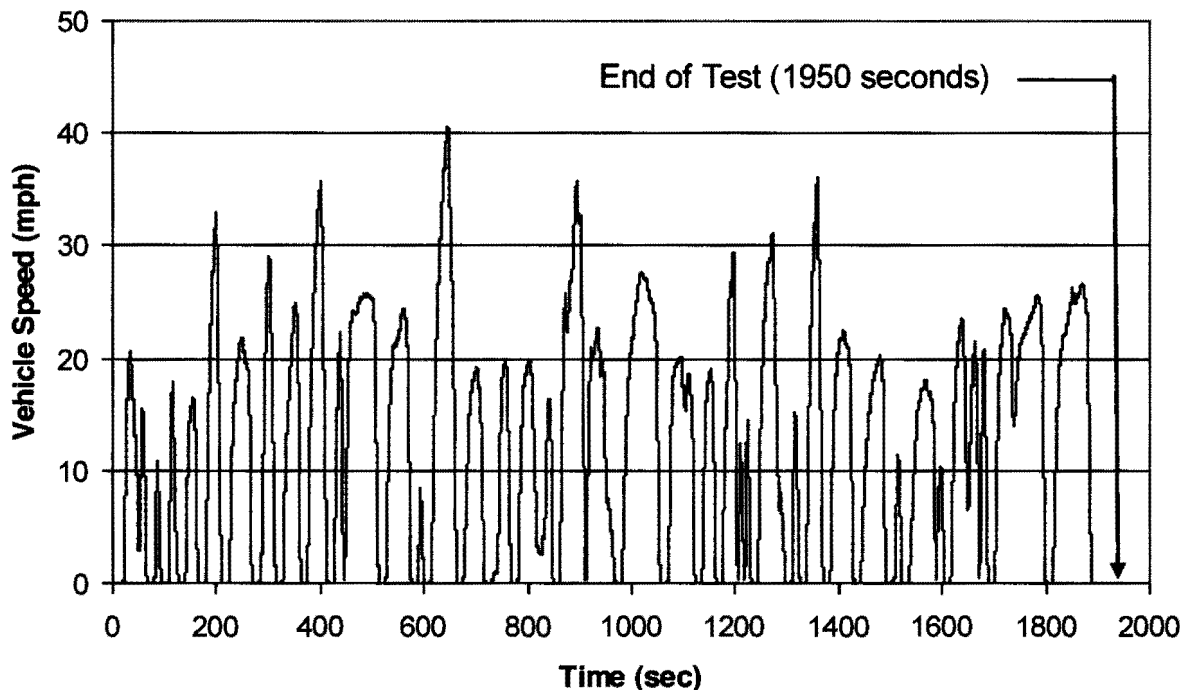
These buses will operate over two routes comprising the Albuquerque Rapid Transit (ART) BRT lines. Both lines operate from the same Central and Unser Transit Center on the west side, while the eastern terminus of one is the Uptown Transit Center and the other runs to Tramway Blvd. The buses will layover for between 5 and 10 minutes at both the east and west terminus locations. The two transit centers are owned and controlled by ABQ RIDE, while the Tramway Blvd terminus is on a public street. These buses are expected to be in operation for 18 hours each day and cover up to 275 miles during the service day.

***TSD 8. Fuel Economy (Design Operating Profile)***

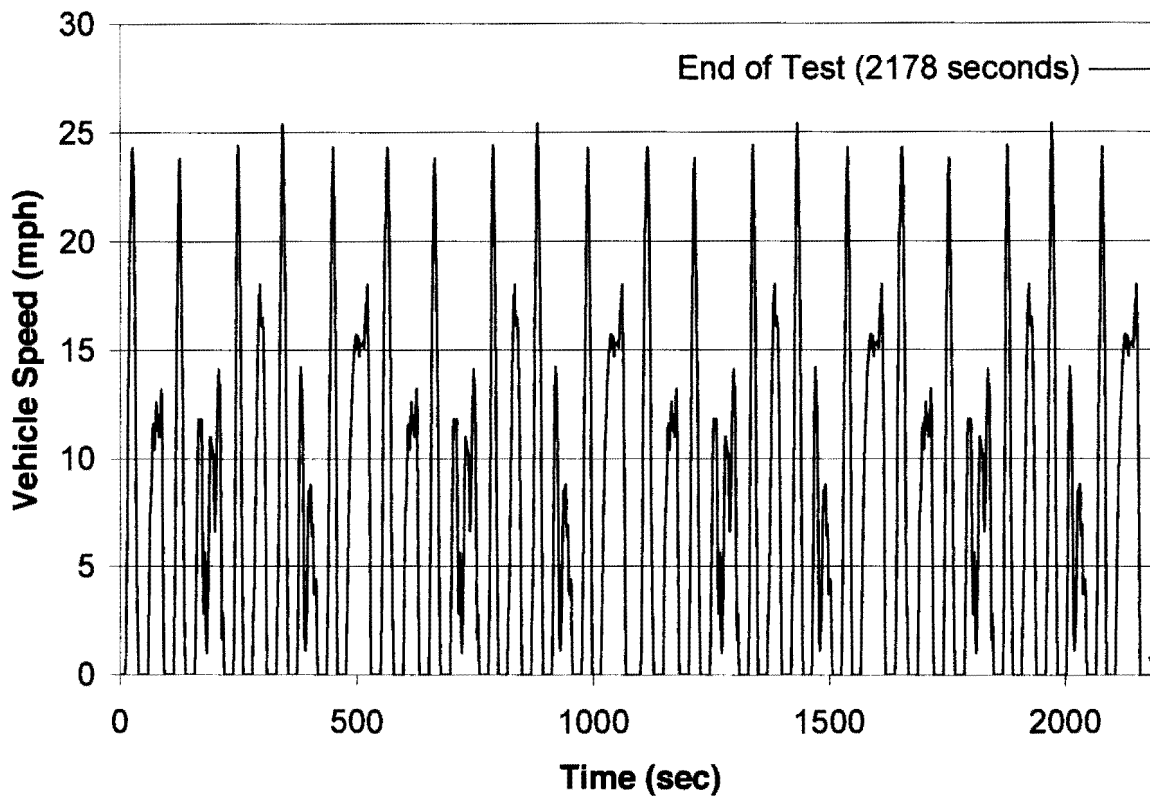
Test results from the Altoona fuel economy tests or other applicable test procedures shall be provided to the City. Results shall include vehicle configuration and test environment information. Fuel economy data shall be provided for each design operating profile. The design operating profile is assumed to be defined by the Altoona fuel duty cycle.

Fuel economy tests shall be run on these four duty cycles.

Duty Cycles: 13 mph  
 Manhattan: 6.8 mph  
 Orange County: 12.7 mph  
 UDDS: 19 mph  
 Idle Time



Orange County Bus Cycle



Double Manhattan Bus Cycle

## POWERPLANT

### OPTION A: CLEAN DIESEL

#### *TSD 9. Engine*

The engine shall comply with applicable local, state, and/or federal emissions and useful life requirements. Components of the fuel management and/or control system shall have a design life of not less than 150,000 miles without replacement or major service. The lifetime estimate is based on the design operating profile.

The engine shall be equipped with an electronically controlled management system, compatible with either 12- or 24-volt power distribution. The engine control system shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. The engine's electronic management system shall monitor operating conditions and provide instantaneous adjustments to optimize both engine and bus performance. The system shall be programmable to allow optimization of programmable features.

The engine starting system shall be protected by an interlock that prevents its engagement when the engine is running. Special equipment or procedures may be employed to start the bus when exposed to temperatures less than 30 °F for a minimum of four hours without the engine in operation. All cold weather starting aids, engine heating devices and procedures shall be of the type recommended by the engine manufacturer and approved by the City. The integration of all systems on the vehicle relative to engine idle speed shall be the responsibility of the vehicle manufacturer to meet the requirements of the transit property.



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

#### **Automatic Engine Protection/Shutdown Override Feature**

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

#### **TSD 9.1 Engine (Clean Diesel)**

Sixty (60) foot buses are to be federally certified, Cummins 330 HP ISL 6 –cylinder diesel engines or approved equal mounted in the rear of the coach. The engine will meet US EPA Emission Standards and supplemental requirements for 2007 and later model year diesel heavy-duty engines and vehicles per 40 CFR 86.007-11.

#### **TSD 9.2 Spare Engine**

Two new engines shall be shipped with this order as spares.

#### ***TSD 10. Cooling Systems***

The cooling systems shall be of sufficient size to maintain all engine and transmission fluids and engine intake air at safe, continuous operating temperatures during the most severe operations possible and in accordance with engine and transmission manufacturers' cooling system requirements. The cooling system fan controls should sense the temperatures of the operating fluids and the intake air, and if either is above safe operating conditions the cooling fan should be engaged. The fan control system shall be designed with a fail-safe mode of "fan on." The cooling system shall meet the requirements stated in the operating environment.

#### **TSD 10.1 Engine Cooling**

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

The radiator and charge air cooler shall be of durable, corrosion-resistant construction with removable tanks.

No screen in front of radiator

#### **Self-Cleaning**

Radiator and charge air cooler fan(s) shall be electrically driven and capable of automated reverse operations for periodic self-cleaning of the radiator and charge air cooler.

#### **Standard Mounting Design**

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

#### **Cooling Fan Controls**

The cooling fan shall be temperature controlled, allowing the engine to reach operating temperature quickly.



### **TSD 10.2 Charge Air Cooling**

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

### **TSD 10.3 Transmission Cooling**

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

### ***TSD 11. Transmission (Conventional Powertrain)***

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

The electronic controls shall be capable of transmitting and receiving electronic inputs and data from other drivetrain components and broadcasting that data to other vehicle systems. Communication between electronic drivetrain components and other vehicle systems shall be made using the communications networks. Electronic controls shall be compatible with either 12- or 24-volt power distribution, provide consistent shift quality and compensate for changing conditions such as variations in vehicle weight and engine power.

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

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

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

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

### **No Automatic Neutral Function**

The transmission shall not incorporate an automatic neutral shift function.

### **TSD 11.1 Spare Transmission**

Two new transmissions shall be shipped with this order as spares.

### ***TSD 12. Retarder***

The powertrain shall be equipped with a retarder designed to extend brake lining service life. The application of the retarder shall cause a smooth blending of both retarder and service brake function and shall activate the brake lights

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

### **Standard Requirement for Retarder Activation**

The retarder shall be adjustable within the limits of the powertrain and activated when the brake pedal is depressed. The City will work with the OEM/drive system manufacturer to determine retarder performance settings. Any time the bus is coasting or slowing down the brake lights shall turn on, with or without regenerative braking engaged.

### **Accessible Retarder Disable Switch**

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

### ***TSD 13. Mounting***

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

#### **TSD 13.1 Service**

The propulsion system shall be arranged for ease of access and maintenance. The Contractor shall list all special tools, fixtures or facility requirements recommended for servicing. The muffler, 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 transmission removal. An engine oil pressure gauge and coolant temperature gauge 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 to prevent leakage. All fluid fill locations shall be properly labeled to help ensure that correct fluid is added. All fillers shall be easily accessible with standard funnels, pour spouts and automatic dispensing equipment. All lubricant sumps shall be fitted with magnetic-type drain plugs.

No engine bypass oil filter.

#### **Engine Oil Pressure and Coolant Temperature Gauges**

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

#### **Engine Air Cleaner**

An air cleaner with a dry filter element and a graduated air filter restriction indicator shall be provided. The location of the air intake system shall be designed to minimize the entry of dust and debris and to maximize the life of the air filter. The engine air duct shall be designed to minimize the

entry of water into the air intake system. Drainage provisions shall be included to allow any water/moisture to drain prior to entry into air filter.

#### ***TSD 14. Hydraulic Systems***

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

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

#### **Hydraulic System Sensors**

Sensors in the main hydraulic system, excluding those in the power steering system, shall indicate on the driver's on-board diagnostic panel conditions of low hydraulic fluid level.

#### **TSD 14.1 Fluid Lines**

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

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

All hoses, pipes, lines and fittings shall be specified and installed per the manufacturer's recommendations.

#### **TSD 14.2 Fittings and Clamps**

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

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

#### **TSD 14.3 Charge Air Piping**

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

restrictions. Piping shall be routed away from heat sources as practicable and shielded as required to meet the temperature rise requirements of the engine manufacturer.

Charge air piping shall be constructed of stainless steel, aluminized steel or anodized aluminum, except between the air filter and turbocharger inlet, where piping may be constructed of fiberglass. Connections between all charge air piping sections shall be sealed with a short section of reinforced hose and secured with stainless steel constant tension clamps that provide a complete 360-degree seal.

#### ***TSD 15. Radiator***

Radiator piping shall be stainless steel or brass tubing, and if practicable, hoses shall be eliminated. Necessary hoses shall be impervious to all bus fluids. All hoses shall be secured with stainless steel clamps that provide a complete 360-degree seal. The clamps shall maintain a constant tension at all times, expanding and contracting with the hose in response to temperature changes and aging of the hose material.

#### ***TSD 16. Oil and Hydraulic Lines***

Oil and hydraulic lines shall be compatible with the substances they carry. The lines shall be designed and intended for use in the environment where they are installed. For example, high-temperature resistant in the engine compartment, resistant to road salts near the road surface, and so on. Lines within the engine compartment shall be composed of steel tubing where practicable, except in locations where flexible lines are required.

Hydraulic lines of the same size and with the same fittings as those on other piping systems of the bus, but not interchangeable, shall be tagged or marked for use on the hydraulic system only.

#### ***TSD 17. Fuel***

##### **TSD 17.1 Fuel Lines**

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

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

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

##### **Fuel Lines, CNG**

Fuel lines shall comply with NFPA-52. All tubing shall be a minimum of seamless Type 304 stainless steel (ASTM A269 or equivalent). Fuel lines and fittings shall not be fabricated from cast iron, galvanized pipe, aluminum, plastic, or copper alloy with content exceeding 70 percent copper. Pipe fittings and hoses shall be clear and free from cuttings, burrs or scale. Pipe thread joining material that is impervious to CNG shall be utilized as required. Fuel lines shall be identifiable as fuel lines only.

High-pressure CNG lines shall be pressure tested to a minimum of 125 percent of system working pressure prior to fueling. CNG, nitrogen or clean, dry air shall be used to pressure test the



lines/assembly. The bus manufacturer shall have a documented procedure for testing the high pressure line assembly.

Fuel lines shall be securely mounted, braced and supported using "split-block" type or stainless steel P clamps; all mounting clamps shall be mounted to a rigid structure to minimize vibration and shall be protected against damage, corrosion or breakage due to strain, rubbing, or wear. "Floating clamps" (not mounted to a rigid structure) shall not be permitted. Fuel lines shall not be used to secure other components (wires, air lines, etc).

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

Fuel hose connections, where permitted, shall be less than 48 in. in length, made from materials resistant to corrosion and action of natural gas, and protected from fretting and high heat and shall be supported approximately every 12 in.

## **TSD 17.2 Design and Construction**

### **TSD 17.2.1 Design and Construction, CNG**

#### **Fuel Containers/Cylinders**

CNG fuel containers/cylinders must be designed, constructed, manufactured, and tested in accordance with at least one of the following:

#### **U.S. Applications:**

NFPA 52-Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems  
FMVSS 304

Any local standard(s) specifically intended for CNG fuel containers

The design and construction of the fuel system supplied by the OEM shall comply with federal and local regulations.

#### **Installation**

Fuel cylinders shall be installed in accordance with ANSI/IAS NGV2 - 1998, Basic Requirements for Compressed Natural Gas Vehicles (NGV) Fuel Containers and NFPA 52, Compressed Natural Gas (CNG) Vehicular Fuel Systems Code, 1998 edition Section 303. In the case of a low floor transit bus, the placement of tanks shall be limited to the roof of the vehicle or in the compartment above the engine of the vehicle.

Fuel cylinders, attached valves, pressure relief devices, and mounting brackets should be installed and protected so that their operation is not affected by bus washers and environmental agents such as rain, snow, ice or mud. These components should be protected from significant damage caused by road debris or collision.

The roof and above the engine mounted tanks shall be contained within a skeletal structure resembling a roll cage and contained within an enclosure. The enclosure shall incorporate a hinged clamshell type access. The access panels shall be designed to offer protection from weather and to be sacrificial as a means of providing an escape path to atmosphere upon rapid enclosure pressure rise. The latching method shall utilize quick release captive hardware that can be demonstrated to last the life of the bus. Additional shielding shall be provided surrounding end fittings and valves as needed. Shields shall be attached to the bus



structure hinged in a manner that permits one mechanic to unlatch and swing the shield open for routine inspections. As practical, electrical components shall not be located within the roof enclosure and if unavoidable, they shall be intrinsically safe.

CNG fueled buses shall be equipped with an active automatic gas detection system which shall annunciate unsafe levels of methane. The automatic gas detection system shall be integrated with an onboard fire suppression system.

The access panels shall also be interlocked via proximity sensors, such that, if other than in their fully closed/locked position, an interlock will prevent engine starter engagement, prevent selection of forward or reverse transmission and shall apply the brake interlock at speeds less than 3 mph.

#### **Labeling**

CNG fuel systems shall be labeled in accordance with NFPA 52, "Compressed Natural Gas (CNG) Vehicular Fuel Systems Code," 1998 edition.

#### **Pressure Relief Devices (PRDs)**

PRDs must be designed, constructed, manufactured and tested in accordance with ANIS/IAS PRD1 - 1998, "Pressure Relief Devices for Natural Gas Vehicle (NGV) Fuel Containers" and ANSI/IAS NGV2-1998, "Basic Requirements for Compressed Natural Gas Vehicle (NGV) Fuel Containers." All natural gas fuel system piping, including the PRD vent line, shall be stainless steel. All PRDs must be vented to outside.

#### **Valves**

Valves must be installed in accordance with ANIS/IAS NGV2 - 1998, "Basic Requirements for Compressed Natural Gas Vehicle (NGV) Fuel Containers" and NFPA 52, "Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems."

#### **Fuel Filler**

The fuel filler shall be located 7 to 38 feet (on a 30-, 35-, 40- and 60-foot coach) behind the centerline of the front door on a side determined by the City. The filler cap shall be retained to prevent loss and shall be recessed into the body.

The fill and vent receptacles shall be located within an enclosure on the right side of the bus. The access door shall be sized to allow full viewing of gauges, ease of hookups and maneuver of fuel nozzle.

The fuel fill receptacle and vent receptacle attachment shall be robust and capable of routine fueling connects/disconnects without deflection or metal fatigue, and capable of withstanding mechanical loads induced by a fueling drive away incident without attachment failure.

The access door interlock shall also power "on" the fuel level gauges/illumination when in the open position.

#### **Fueling System**

The CNG fueling port receptacle shall be an ANSI/AGA NGV1 or NGV2 certified receptacle as designated by the City. The coach shall be capable of being fueled by a nozzle determined by the City. The fueling port receptacle location shall be such that connection by

fueling personnel can be performed without physical strain or interference. A dust cap shall be permanently "tethered" to the fueling port receptacle. The fueling port receptacle access door shall be equipped with an interlock sensor that disables the engine starting system when the access door is open, to prevent drive-aways. The interlock shall be of the type such that if the sensor fails, the coach will not start.

Fueling site characteristics such as pressure, flow rate, and temperature shall be provided by the City.

#### **Defueling System**

The CNG defueling port shall be an NGV-3.1/CGA-12.3 certified receptacle. The CNG defueling port shall be located on the curbside of the coach, in a location that is compatible with the City's defueling station operation. The de-fueling system shall incorporate the following characteristics:

- Dust cap permanently "tethered" to the defueling port.
- Device(s) to prevent inadvertent defueling. Specifications to be provided by City.
- Components compatible with City's defueling operation.
- The piping and fittings onboard the bus shall be sized to allow the fueling station to meet the following operating parameters:

The atmospheric-vent system shall allow a bus with 20,000 scf of onboard CNG storage to defuel to atmospheric pressure within 80 minutes.

Location/method of attaching CNG fuel system to earth ground.

#### **TSD 17.3 Diesel Fuel Tank**

The diesel fuel take shall be made of aluminium and have a capacity of 125 U.S. gallons.

#### ***TSD 18. Emissions and Exhaust***

##### **TSD 18.1 Exhaust Emissions**

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

##### **TSD 18.2 Exhaust System**

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

##### **TSD 18.3 Exhaust After treatment**

An exhaust after treatment system will be provided to ensure compliance to all applicable EPA regulations in effect.

##### **Diesel Exhaust Fluid Injection**

If required by the engine manufacturer to meet NOx level requirements specified by EPA, a DEF injection system will be provided. The DEF system will minimally include a tank, an injector, a pump, an ECM and a selective catalytic converter. The tanks shall be designed to store DEF in the

operating environment described in the "Operating Environment" section. The DEF fluid lines shall be designed to prevent the DEF from freezing. The DEF injection system shall not be damaged from a cold soak at 10 °F.

#### **TSD 18.4 Particulate Aftertreatment**

If required by the engine manufacturer to meet particulate level requirements specified by EPA, a particulate trap will be provided. The particulate trap shall regenerate itself automatically if it senses clogging. Regeneration cycles and conditions will be defined by the engine manufacturer.

### **STRUCTURE**

#### ***TSD 19. General***

##### **TSD 19.1 Design**

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

#### ***TSD 20. Altoona Testing***

##### **Altoona Test Report Provided to City as Part of Bid Package**

Prior to responding to the Request for Bids, the structure of the proposed bus model shall have undergone appropriate structural testing and/or analysis, including the complete regimen of FTA required Altoona tests. As part of its bid submittal, the OEM shall provide the City with a completed report of Altoona testing for the proposed bus model along with a plan of corrective action to address deficiencies, breakdowns and other issues identified during Altoona testing. The bus model tested shall match the bus model proposed for procurement, including structure, axles and drive-train. Base model and partial Altoona test reports are acceptable when the combination of these tests adequately represents the proposed bus model. Bid submittals lacking completed reports of Altoona testing will be deemed unresponsive.

##### **TSD 20.1 Structural Validation**

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

The structure of the proposed bus model shall have undergone structural testing prior to assembly of the first bus. The OEM shall provide the City with completed reports of other structural tests as specified by the City.

#### ***TSD 21. Distortion***

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

#### ***TSD 22. Resonance and Vibration***

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

### **TSD 22.1 Engine Compartment Bulkheads**

The passenger and engine compartment shall be separated by fire-resistant bulkheads. The engine compartment shall include areas where the engine and exhaust system are housed. This bulkhead shall preclude or retard propagation of an engine compartment fire into the passenger compartment and shall be in accordance with the Recommended Fire Safety Practices defined in FTA Docket 90A, dated October 20, 1993. Only necessary openings shall be allowed in the bulkhead, and these shall be fire-resistant. Any passageways for the climate control system air shall be separated from the engine compartment by fire-resistant material. Piping through the bulkhead shall have fire-resistant fittings sealed at the bulkhead. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the bulkhead. Engine access panels in the bulkhead shall be fabricated of fire-resistant material and secured with fire-resistant fasteners. These panels, their fasteners and the bulkhead shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the bulkhead.

### **TSD 22.2 Crashworthiness**

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

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

Exterior panels below 35 in. from ground level shall withstand a static load of 2000 lbs applied perpendicular to the bus by a pad no larger than 5 sq in. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the bus.

### ***TSD 23. Corrosion***

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

All materials that are not inherently corrosion resistant shall be protected with corrosion-resistant coatings. All joints and connections of dissimilar metals shall be corrosion resistant and shall be protected from galvanic corrosion. Representative samples of all materials and connections shall withstand a two-week (336-hour) salt spray test in accordance with ASTM Procedure B-117 with no structural detrimental effects to normally visible surfaces and no weight loss of over 1 percent.

### **Corrosion Resistance Requirements for Exposed and Interior Surfaces of Tubing Throughout Entire Vehicle**

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

### ***TSD 24. Towing***

Towing devices shall be provided on the front end of the bus. Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 degrees of the

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longitudinal axis of the bus. If applicable, the rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components.

A plug connector permanently mounted at the front of the bus shall provide for bus tail lamp, marker, stop and turn signal lamp operation as controlled from the towing vehicle. The connector shall include a spring-loaded dust- and water-resistant cap. Shop air connectors shall be provided at the front and rear of the bus and shall be capable of supplying all pneumatic systems of the bus with externally sourced compressed air. The location of these shop air connectors shall facilitate towing operations.

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

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

Two rear recovery devices/tie downs shall permit lifting and towing of the bus for a short distance, such as in cases of an emergency, to allow access to provisions for front towing of bus. The method of attaching the tow bar or adapter shall require the specific approval of the City. Any tow bar or adapter exceeding 50 lbs. should have means to maneuver or allow for ease of use and application. Each towing device shall accommodate a crane hook with a 1 in. throat.

#### ***TSD 25. Jacking***

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

#### **Yellow Pads**

Jacking pads shall be painted safety yellow.

#### ***TSD 26. Hoisting***

The bus axles or jacking plates shall accommodate the lifting pads of a two-post hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.

#### ***TSD 27. Floor***

##### **TSD 27. 1 Design**

The floor shall be essentially a continuous plane, except at the wheel housings and platforms. Where the floor meets the walls of the bus, as well as other vertical surfaces such as platform risers, the surface edges shall be blended with a circular section of radius not less than ¼ in. or installed in a fully sealed butt joint. Similarly, a molding or cover shall prevent debris accumulation between the floor and wheel housings. The vehicle floor in the area of the entrance and exit doors shall have a lateral slope not exceeding 2 degrees to allow for drainage.



**Bi-level Floor Design**

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

**TSD 27.2 Strength**

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

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

**TSD 27.3 Construction**

The floor shall consist of the subfloor and the floor covering that will last the life of the bus. The floor as assembled, including the sealer, attachments and covering, shall be waterproof, non-hygroscopic and resistant to mold growth. The subfloor shall be resistant to the effects of moisture, including decay (dry rot). It shall be impervious to wood-destroying insects such as termites.

**Pressure-Preserved Plywood Panel**

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

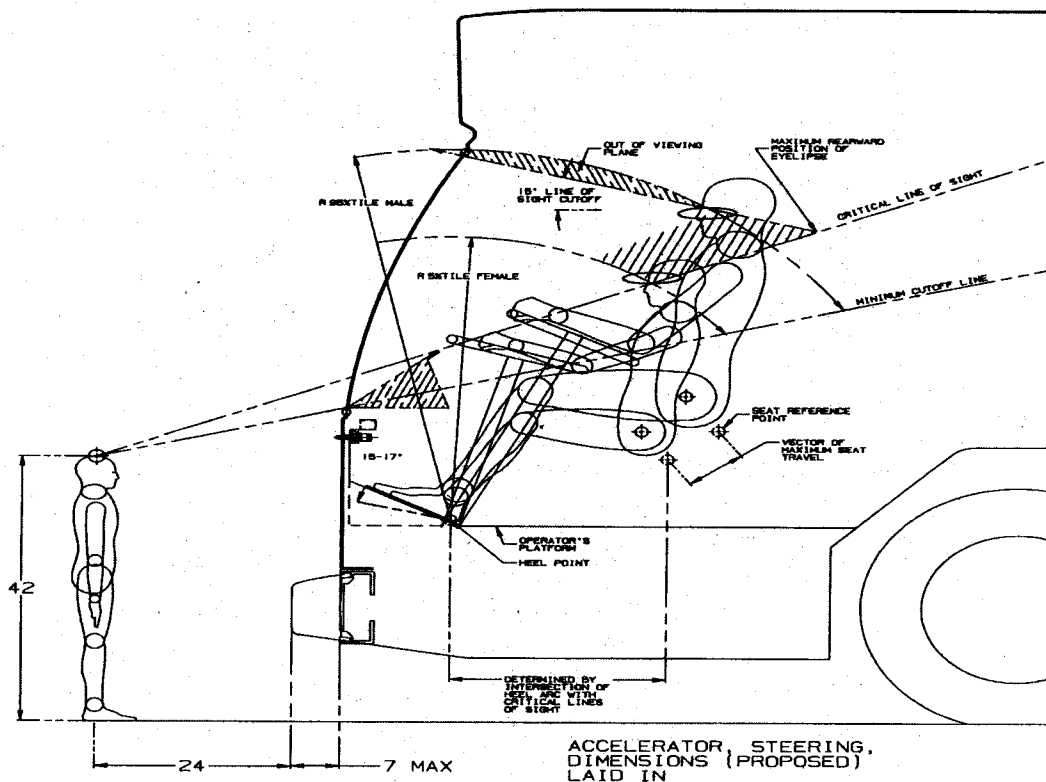
***TSD 28. Platforms*****TSD 28.1 Driver's Area**

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

**TSD 28.2 Driver's Platform**

The driver's platform shall be of a height such that, in a seated position, the driver can see an object located at an elevation of 42 in. above the road surface, 24 in. from the leading edge of the bumper. Notwithstanding this requirement, the platform height shall not position the driver such that the driver's vertical upward view is less than 15 degrees. A warning decal or sign shall be provided to alert the driver to the change in floor level. Figure 3 illustrates a means by which the platform height can be determined, using the critical line of sight.

**FIGURE 3**  
Determining Platform Height

**Farebox**

Farebox placement should minimize impact to passenger access and minimize interference with the driver's line of sight. City will provide directional placement of farebox.

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

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

**TSD 28.4 Rear Step Area to Rear Area**

If the vehicle is of a bi-level floor design, a rear step area shall be provided along the center aisle of the bus to facilitate passenger traffic between the upper and lower floor levels. This step area shall be cut into the rear platform and shall be approximately the aisle width, a minimum 12 in. deep and approximately half the height of the upper level relative to the lower level. The horizontal surface of this platform shall be covered with skid-resistant material with a visually contrasting nosing and

shall be sloped slightly for drainage. A warning decal or sign shall be provided at the immediate platform area to alert passengers to the change in floor level.

## ***TSD 29. Wheel Housing***

### **TSD 29.1 Design and Construction**

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

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

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

The finish of the front wheel housings shall be scratch-resistant and complement interior finishes of the bus to minimize the visual impact of the wheel housing. If fiberglass wheel housings are provided, then they shall be color-impregnated to match interior finishes. The lower portion extending to approximately 10 to 12 in. above floor shall be equipped with scuff-resistant coating or stainless steel trim.

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

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

## **CHASSIS**

### ***TSD 30. Suspension***

#### **TSD 30.1 General Requirements**

The front, rear and mid (if articulated) suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Routine adjustments shall be easily accomplished by limiting the removal or disconnecting the components.

#### **TSD 30.2 Alignment**

All axles should be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

#### **TSD 30.3 Springs and Shock Absorbers**

##### **TSD 30.3.1 Suspension Travel**

The suspension system shall permit a minimum wheel travel of 2.75 in. jounce-upward travel of a wheel when the bus hits a bump (higher than street surface), and 2.75 in. rebound-downward travel when the bus comes off a bump and the wheels fall relative to the body. Elastomeric bumpers shall be provided at the limit of jounce travel. Rebound travel may be

limited by elastomeric bumpers or hydraulically within the shock absorbers. Suspensions shall incorporate appropriate devices for automatic height control so that regardless of load the bus height relative to the centerline of the wheels does not change more than  $\frac{1}{2}$  in. at any point from the height required. The safe operation of a bus cannot be impacted by ride height up to 1 in. from design normal ride height.

### **TSD 30.3.2 Damping**

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

### **TSD 30.3.3 Lubrication**

#### **Standard Grease Fittings**

All elements of steering, suspension and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534. These fittings shall be located for ease of inspection and shall be accessible with a standard grease gun from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. The lubricant specified shall be standard for all elements on the bus serviced by standard fittings and shall be required no less than every 6000 miles.

### **TSD 30.3.4 Kneeling**

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

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

The brake and throttle interlock shall prevent movement when the bus is kneeled. The kneeling control shall be disabled when the bus is in motion. The bus shall kneel at a maximum rate of 1.25 in. per second at essentially a constant rate. After kneeling, the bus shall rise within 3 seconds to a height permitting the bus to resume service and shall rise to the correct operating height within 7 seconds regardless of load up to GVWR. During the lowering and raising operation, the maximum vertical acceleration shall not exceed 0.2g, and the jerk shall not exceed 0.3g/second.

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

### ***TSD 31. Wheels and Tires***

#### **TSD 31.1 Wheels**

All wheels shall be interchangeable and shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986.

#### **Painted Steel**

Wheels and rims shall be hub-piloted with metallic silver powder coated steel (maximum 3.5 mil) and shall resist rim flange wear.

#### **TSD 31.2 Tires**

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

The tires shall be provided under a lease agreement between the City and the tire supplier and shall be 305/70 R225

### ***TSD 32. Steering***

Hydraulically assisted steering shall be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. Engine driven hydraulic pump shall be provided for power steering.

#### **TSD 32.1 Steering Axle**

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

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

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

The steering geometry of the outside (frontlock) wheel shall be within 2 degrees of true Ackerman up to 50 percent lock measured at the inside (backlock) wheel. The steering geometry shall be within 3 degrees of true Ackerman for the remaining 100 percent lock measured at the inside (backlock) wheel.

#### **TSD 32.2 Wheel**

##### **TSD 32.2.1 Turning Effort**

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

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

Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 lbs at the steering wheel rim, and perceived free play



in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

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

#### **TSD 32.2.2 Steering Wheel, General**

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

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

#### **TSD 32.2.3 Steering Column Tilt**

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

#### **TSD 32.2.4 Steering Wheel Telescopic Adjustment**

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

**TABLE 5**  
Steering Wheel Height<sup>1</sup> Relative to Angle of Slope

At Minimum Telescopic Height Adjustment (29 in.)		At Maximum Telescopic Height Adjustment (5 in.)	
Angle of Slope	Height	Angle of Slope	Height
0 degrees	29 in.	0 degrees	34 in.
15 degrees	26.2 in.	15 degrees	31.2 in.
25 degrees	24.6 in.	25 degrees	29.6 in.
35 degrees	22.5 in.	35 degrees	27.5 in.

1. Measured from bottom portion closest to driver.

#### **TSD 33. Drive Axle**

The bus shall be driven by a heavy-duty axle with a load rating sufficient for the bus loaded to GVWR. The drive axle shall have a design life to operate for not less than 300,000 miles on the design operating profile without replacement or major repairs. The lubricant drain plug shall be magnetic type. If a planetary gear design is employed, the oil level in the planetary gears shall be easily checked through the plug or sight gauge. The axle and driveshaft components shall be rated for both propulsion and retardation modes with respect to duty cycle.

**NOTE:** The retardation duty cycle can be more aggressive than propulsion.

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

### **TSD 33.1 Non-Drive Axle**

The non-drive axle is the drive axle without the drive gear with a load rating sufficient for the load to GVWR.

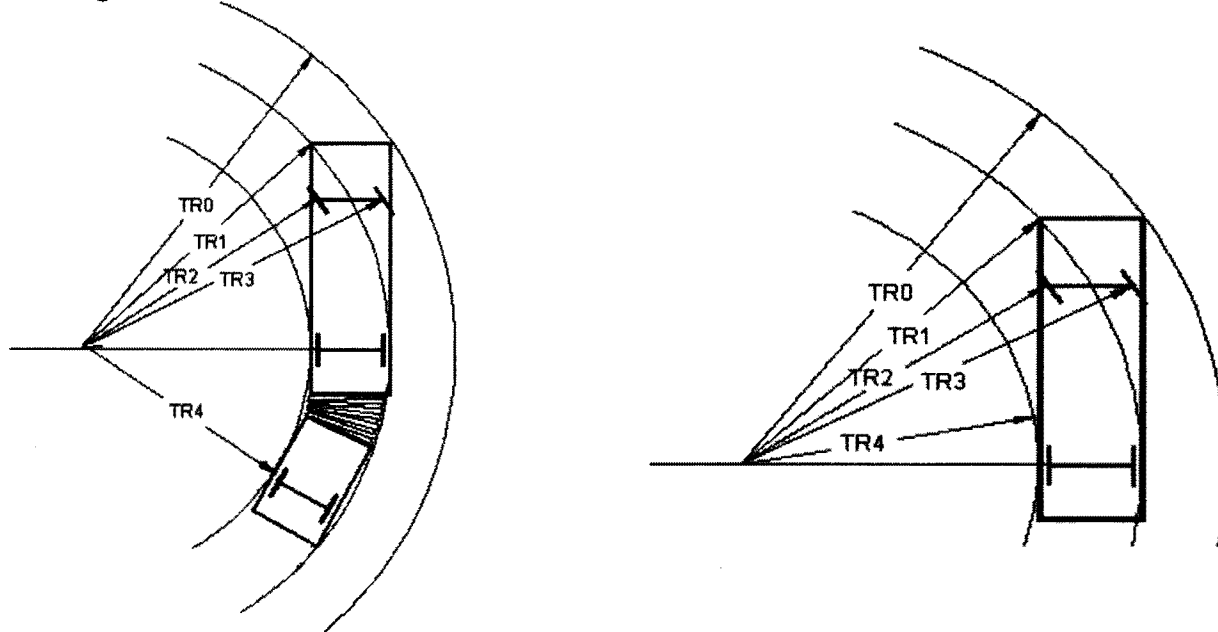
### **TSD 34. Turning Radius**

**TABLE 4**  
Maximum Turning Radius

Bus (approximate)	Length	Maximum (see Figure 4)	Turning Radius
60 ft		44 ft. (TR0)	

**FIGURE 4**

Turning Radius



### **TSD 35. Brakes**

#### **TSD 35.1 Service Brake**

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

#### **TSD 35.2 Actuation**

##### **Air-Actuated Brakes**

Service brakes shall be controlled and actuated by a compressed air system. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 70 lbs at a point 7 in. above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver's heel when his or her foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. The ECU for the ABS system shall be protected, yet in an accessible location to allow for ease of service.

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

No automatic traction control.

### **TSD 35.3 Friction Material**

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

### **TSD 35.4 Hubs and Drums**

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

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

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

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

### **TSD 35.5 Parking/Emergency Brake**

#### **Air Brakes**

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

### **TSD 35.6 Electronic Brake Monitoring System**

Each bus is to include a brake monitoring as part of the vehicle air disc braking on-board diagnostic system. The Brake Monitoring System (BMS) shall monitor both parking brakes and service brakes. The BMS system shall be designed to detect over-stroke, non-functioning, brake drag and low pad-to-rotor clearance conditions at each vehicle wheel end.

Any wheel-end brake fault condition detected by the BMS shall be communicated via SAE brake fault codes over the vehicle J-1939 network in real-time. These predefined fault codes shall provide instant warnings to operations and maintenance of critical brake system problems which may affect the safe operation of vehicle.

The on-board BMS shall be designed to augment safety and to aid maintenance in determining when to perform necessary unscheduled maintenance to address vehicle performance or safety concerns in a timely manner. The system shall provide a log of stored fault codes for later retrieval by maintenance personnel to be utilized by maintenance personnel for vehicle troubleshooting.

## ***TSD 36. Interlocks***

### **TSD 36.1 Passenger Door Interlocks**

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

To preclude movement of the bus, an accelerator interlock shall lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus when the driver's door control is moved to a mid/rear door enable or open position, or a mid or rear door panel is opened more than 3 in. from the fully closed position (as measured at the leading edge of the door panel). The interlock engagement shall bring the bus to a smooth stop and shall be capable of holding a fully loaded bus on a 6 percent grade, with the engine at idle and the transmission in gear, until the interlocks are released. These interlock functions shall be active whenever the vehicle Master Run Switch is in any run position.

All door systems employing brake and accelerator interlocks shall be supplied with supporting failure mode effects analysis (FEMA) documentation, which demonstrates that failure modes are of a failsafe type, thereby never allowing the possibility of release of interlock while an interlocked door is in and unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

Braking effort adjustable with hand tools.

No requirements for accelerator and brake interlocks whenever front doors are open.

### **Requiring Accelerator Interlock Whenever Rear Doors Are Open**

An accelerator interlock shall lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus whenever the middle or rear doors are open.

## ***TSD 37. Pneumatic System***

### **TSD 37.1 General**

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

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

### **TSD 37.2 Air Compressor**

The engine-driven air compressor shall be sized to charge the air system from 40 psi to the governor cut-off pressure in less than 4 minutes while not exceeding the fast idle speed setting of the engine.

### **TSD 37.3 Air Lines and Fittings**

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J1149 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE

Standard J844 for nylon tubing if not subject to temperatures over 200 °F. The air on the delivery side of the compressor where it enters nylon housing shall not be above the maximum limits as stated in SAE J844. Nylon tubing shall be installed in accordance with the following color-coding standards:

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

Line supports shall prevent movement, flexing, tension, strain and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. To the extent practicable and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5-ft intervals. Nylon lines may be grouped and shall be supported at 30 in. intervals or less.

The compressor discharge line between powerplant and body-mounted equipment shall be flexible convoluted copper or stainless steel line, or may be flexible Teflon hose with a braided stainless steel jacket. Other lines necessary to maintain system reliability shall be flexible Teflon hose with a braided stainless steel jacket. End fittings shall be standard SAE or JIC brass or steel, flanged, swivel-type fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2-ft intervals or less.

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

#### **TSD 37.4 Air Reservoirs**

All air reservoirs shall meet the requirements of FMVSS Standard 121 and SAE Standard J10 and shall be equipped with drain plugs and guarded or flush type drain valves. Major structural members shall protect these valves and any automatic moisture ejector valves from road hazards. Reservoirs shall be sloped toward the drain valve. All air reservoirs shall have drain valves that discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

#### **TSD 37.5 Air System Dryer**

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

No requirements for additional oil separator provision.

## **ELECTRICAL, ELECTRONIC AND DATA COMMUNICATION SYSTEMS**

### ***TSD 38. Overview***

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



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

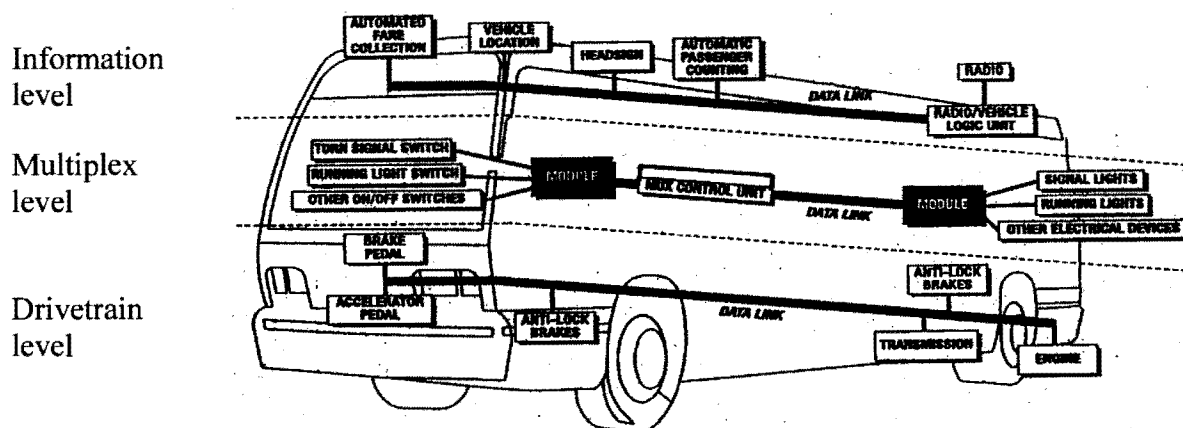
The data communication system consists of the bi-directional communications networks that electronic devices use to share data with other electronic devices and systems. Communication networks are essential to integrating electronic functions, both onboard the vehicle and off.

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

Data communications systems are divided into three levels to reflect the use of multiple data networks:

- **Drivetrain level:** Components related to the drivetrain including the propulsion system components (engine, transmission and hybrid units), and anti-lock braking system (ABS), which may include traction control.
- **Information level:** Components whose primary function is the collection, control or display of data that is not necessary to the safe drivability of the vehicle (i.e., the vehicle will continue to operate when those functions are inoperable). These components typically consist of those required for automatic vehicle location (AVL) systems, destination signs, fare boxes, passenger counters, radio systems, automated voice and signage systems, video surveillance and similar components.
- **Multiplex level:** Electrical or electronic devices controlled through input/output signals such as discrete, analog and serial data information (i.e., on/off switch inputs, relay or relay control outputs). Multiplexing is used to control components not typically found on the drivetrain or information levels, such as lights; wheelchair lifts; doors; heating, ventilation and air conditioning (HVAC) systems; and gateway devices.

**FIGURE 5**  
Data Communications Systems Levels



### TSD 38.1 Modular Design

Design of the electrical, electronic and data communication systems shall be modular so that each electronic device, apparatus panel, or wiring bundle is easily separable from its interconnect by means of connectors.

Powerplant wiring shall be an independent wiring harness. Replacement of the engine compartment wiring harness(es) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

### **TSD 39. Environmental and Mounting Requirements**

The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed, as recommended in SAE J1455.

Electrical and electronic equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electrical system when operating within the design operating profile. As a recommendation, no vehicle component shall generate, or be affected by, electromagnetic interference or radio frequency interference (EMI/RFI) that can disturb the performance of electrical/electronic equipment as defined in SAE J1113 and UNECE Council Directive 95/54 (R 10).

The City shall follow recommendations from bus manufacturers and subsystem Suppliers regarding methods to prevent damage from voltage spikes generated from welding, jump starts, shorts, etc.

#### **TSD 39.1 Hardware Mounting**

The mounting of the hardware shall not be used to provide the sole source ground, and all hardware shall be isolated from potential EMI/RFI, as referenced in SAE J1113.

All electrical/electronic hardware mounted in the interior of the vehicle shall be inaccessible to passengers and hidden from view unless intended to be viewed. The hardware shall be mounted in such a manner as to protect it from splash or spray.

All electrical/electronic hardware mounted on the exterior of the vehicle that is not designed to be installed in an exposed environment shall be mounted in a sealed enclosure.

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

### ***TS 40. General Electrical Requirements***

#### **TSD 40.1 Batteries**

##### **TSD 40.1.1. Low-Voltage Batteries (24V)**

##### **Four Group 31 Maintenance-Free Batteries**

Four Group 31 Series deep cycling maintenance-free battery units shall be provided. Each battery shall have a minimum of 730 to 750 cold cranking amps. Each battery shall have a purchase date no more than one year from the date of release for shipment to the City.

##### **Same Size Terminal Ends**

Positive and negative terminal ends shall be the same size.

##### **TSD 40.1.2 Battery Cables**

The battery terminal ends and cables shall be color-coded with red for the primary positive, black for negative and another color for any intermediate voltage cables. Positive and negative battery cables shall not cross each other if at all possible, be flexible and sufficiently long to reach the batteries with the tray in the extended position without stretching or pulling on any connection and shall not lie directly on top of the batteries. Except as interrupted by the master battery switch, battery and starter wiring shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE Standard J1127 – Type SGT, SGX or GXL and SAE Recommended Practice J541.

2100 strand 4/0 cable or greater recommended. Color code each voltage.

### **TSD 40.1.3 Jump-Start**

#### **Jump-Start Connector**

An Anderson Jump-Start Connector, red for 24V and blue for 12V, shall be provided in the engine compartment, equipped with dust cap and adequately protected from moisture, dirt and debris.

Customer will specify location.

### **TSD 40.1.4 Battery Compartment**

The battery compartment shall prevent accumulation of snow, ice and debris on top of the batteries and shall be vented and self-draining. It shall be accessible only from the outside of the vehicle. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the electrolyte. The inside surface of the battery compartment's access door shall be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose.

The vehicle shall be equipped with a 12VDC and 24VDC quick disconnect switch(es). The battery compartment door shall conveniently accommodate operation of the 12VDC and 24VDC quick disconnect switch(es).

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

The battery hold-down bracket shall be constructed of a non-metallic material (plastic or fiberglass).

This access door shall not require any special locking devices to gain access to the switch, and it shall be accessible without removing or lifting the panel. The door shall be flush-fitting and incorporate a spring tensioner or equal to retain the door in a closed position when not in use.

The batteries shall be securely mounted on a stainless steel or equivalent tray that can accommodate the size and weight of the batteries. The battery tray shall pull out easily and properly support the batteries while they are being serviced. The tray shall allow each battery cell to be easily serviced and filled. A locking device shall retain the battery tray to the stowed position.

If not located in the engine compartment, the same fire-resistant properties must apply to the battery compartment. No sparking devices should be located within the battery box.

### **TSD 40.1.5 Auxiliary Electronic Power Supply**

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

#### **TSD 40.1.6 Master Battery Switch**

A single master switch shall be provided near the battery compartment for the disconnecting of all battery positives (12V and 24V), except for safety devices such as the fire suppression system and other systems as specified. The location of the master battery switch shall be clearly identified on the exterior access panel, be accessible in less than 10 seconds for deactivation and prevent corrosion from fumes and battery acid when the batteries are washed off or are in normal service.

Turning the master switch off with the powerplant operating shall shut off the engine and shall not damage any component of the electrical system. The master switch shall be capable of carrying and interrupting the total circuit load.

#### **Single Switch**

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

#### **TSD 40.1.7 Low-Voltage Generation and Distribution**

The low-voltage generating system shall maintain the charge on fully charged batteries, except when the vehicle is at standard idle with a total low voltage generator load exceeding 70 percent of the low voltage generator nameplate rating.

Voltage monitoring and over-voltage output protection (recommended at 32V) shall be provided.

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

#### **TSD 40.1.8 Circuit Protection**

All branch circuits, except battery-to-starting motor and battery-to-generator/alternator circuits, shall be protected by current-limiting devices such as circuit breakers, fuses or solid state devices sized to the requirements of the circuit. Electronic circuit protection for the cranking motor shall be provided to prevent engaging of the motor for more than 30 seconds at a time to prevent overheating. The circuit breakers or fuses shall be easily accessible for authorized personnel. Fuses shall be used only where it can be demonstrated that circuit breakers are not practicable. This requirement applies to in-line fuses supplied by either the Contractor or a Supplier. Fuse holders shall be constructed to be rugged and waterproof. All manual reset circuit breakers critical to the operation of the bus shall be mounted in a location convenient to the City mechanic with visible indication of open circuits. The City shall consider the application of automatic reset circuit breakers on a case-by-case basis. The Contractor shall show all in-line fuses in the final harness drawings. Any manually resettable circuit breakers shall provide a visible indication of open circuits.

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

**TSD 40.2 Grounds**

The battery shall be grounded to the vehicle chassis/frame at one location only, as close to the batteries as possible. When using a chassis ground system, the chassis shall be grounded to the frame in multiple locations, evenly distributed throughout the vehicle to eliminate ground loops. No more than four ground ring/spade terminal connections shall be made per ground stud. Electronic equipment requiring an isolated ground to the battery (i.e., electronic ground) shall not be grounded through the chassis.

**TSD 40.3 Low Voltage/Low Current Wiring and Terminals**

All power and ground wiring shall conform to specification requirements of SAE Recommended Practice J1127, J1128 and J1292. Double insulation shall be maintained as close to the junction box, electrical compartment or terminals as possible. The requirement for double insulation shall be met by wrapping the harness with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid or flexible conduit.

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

Strain-relief fittings shall be provided at all points where wiring enters electrical compartments. Grommets or other protective material shall be installed at points where wiring penetrates metal structures outside of electrical enclosures. Wiring supports shall be protective and non-conductive at areas of wire contact and shall not be damaged by heat, water, solvents or chafing.

To the extent practicable, wiring shall not be located in environmentally exposed locations under the vehicle. Wiring and electrical equipment necessarily located under the vehicle shall be insulated from water, heat, corrosion and mechanical damage. Where feasible, front to rear electrical harnesses should be installed above the window line of the vehicle.

All wiring harnesses over 5 ft long and containing at least five wires shall include 10 percent (minimum one wire) excess wires for spares. This requirement for spare wires does not apply to data links and communication cables. Wiring harness length shall allow end terminals to be replaced twice without pulling, stretching or replacing the wire. Terminals shall be crimped to the wiring according to the connector manufacturer's recommendations for techniques and tools. All cable connectors shall be locking type, keyed and sealed, unless enclosed in watertight cabinets or vehicle interior. Pins shall be removable, crimp contact type, of the correct size and rating for the wire being terminated. Unused pin positions shall be sealed with sealing plugs. Adjacent connectors shall either use different inserts or different insert orientations to prevent incorrect connections.

Terminals shall be crimped, corrosion-resistant and full ring type or interlocking lugs with insulating ferrules. When using pressure type screw terminal strips, only stranded wire shall be used. Insulation clearance shall ensure that wires have a minimum of "visible clearance" and a maximum of two times the conductor diameter or 1/16 in., whichever is less. When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands that can penetrate the insulation of the inner wires.



Ultra-sonic and T-splices may be used with 7 AWG or smaller wire. When a T-splice is used, it shall meet these additional requirements:

- It shall include a mechanical clamp in addition to solder on the splice.
- The wire shall support no mechanical load in the area of the splice.
- The wire shall be supported to prevent flexing.

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

Wiring located in the engine compartment shall be routed away from high-heat sources or shielded and/or insulated from temperatures exceeding the wiring and connector operating requirements.

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

#### **TSD 40.4 Electrical Components**

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

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

#### **TSD 40.5 Electrical Compartments**

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

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

#### ***TSD 41. General Electronic Requirements***

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

All electronic component Suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and also in over-voltage (over 32V DC on a 24V DC nominal voltage rating with a maximum of 50V DC) and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors. Where this is not possible, the use of a pull-up or pull-down resistor shall be limited as much as possible and easily accessible and labeled.

### **TSD 41.1 Wiring and Terminals**

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

#### **TSD 41.1.1 Discrete I/O (Inputs/Outputs)**

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

#### **TSD 41.1.2 Shielding**

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

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

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

#### **TSD 41.1.3 Communications**

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

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

#### **TSD 41.1.4 Radio Frequency (RF)**

RF components, such as radios, video devices, cameras, global positioning systems (GPS), etc., shall use coaxial cable to carry the signal. All RF systems require special design consideration for losses along the cable. Connectors shall be minimized, since each connector and crimp has a loss that will attribute to attenuation of the signal. Cabling should allow for the removal of antennas or attached electronics without removing the installed cable between them. If this cannot be done, then a conduit of sufficient size shall be provided for ease of attachment of antenna and cable assembly. The corresponding component vendors shall be consulted for proper application of equipment, including installation of cables.

### **TSD 41.1.5 Audio**

Cabling used for microphone level and line level signals shall be 22 AWG minimum with shielded twisted pair. Cabling used for amplifier level signals shall be 18 AWG minimum.

## ***TSD 42. Multiplexing***

### **TSD 42.1 General**

The primary purpose of the multiplexing system is control of components necessary to operate the vehicle. This is accomplished by processing information from input devices and controlling output devices through the use of an internal logic program.

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

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

### **TSD 42.2 System Configuration**

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

#### **TSD 42.2.1 I/O Signals**

The input/output for the multiplex system may contain three types of electrical signals: discrete, analog or serial data.

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

## ***TSD 43. Data Communications***

### **TSD 43.1 General**

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

- Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking and transport (bulk transfer of data to/from the device).
- Data definition requirements that ensure access to diagnostic information and performance characteristics.

- The capability and procedures for uploading new application or configuration data.
- Access to revision levels of data, application software and firmware.
- The capability and procedures for uploading new firmware or application software.
- Evidence that applicable data shall be broadcast to the network in an efficient manner such that the overall network integrity is not compromised.

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

### **TSD 43.2 Drivetrain Level**

Drivetrain components, consisting of the engine, transmission, retarder, anti-lock braking system and all other related components, shall be integrated and communicate fully with respect to vehicle operation with data using SAE Recommended Communications Protocols such as J1939 with forward and backward compatibilities or other open protocols.

#### **TSD 43.2.1 Diagnostics, Fault Detection and Data Access**

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

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

#### **TSD 43.2.2 Programmability (Software)**

The drivetrain level components shall be programmable by the City with limitations as specified by the sub-system Supplier.

### **TSD 43.3 Multiplex Level**

#### **TSD 43.3.1 Data Access**

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

#### **TSD 43.3.2 Diagnostics and Fault Detection**

The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (online) or inactive (offline) faults through the use of on-board visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or a handheld unit. Either unit shall have the ability to check logic function. The diagnostic data can be incorporated into the information level network or the central data access system.

No requirement for mock-up board.

### **TSD 43.3.3 Programmability (Software)**

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

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

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

- hardware component identification where labels are included on all multiplex hardware to identify components
- hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module
- software revision identification where all copies of the software in service displays the most recent revision number
- a method of determining which version of the software is currently in use in the multiplex system

Revision control labels shall be electronic.

### **TSD 43.4 Electronic Noise Control**

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

Electrical and electronic sub-systems on the coaches shall not be affected by external sources of RFI/EMI. This includes, but is not limited to, radio and TV transmission, portable electronic devices including computers in the vicinity of or onboard the buses, ac or dc power lines and RFI/EMI emissions from other vehicles.

## **DRIVER PROVISIONS, CONTROLS AND INSTRUMENTATION**

### ***TSD 44. Driver's Area Controls***

#### **TSD 44.1 General**

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

Switches and controls shall be divided into basic groups and assigned to specific areas, in conformance with SAE Recommended Practice J680, Revised 1988, "Location and Operation of Instruments and Controls in Motor Truck Cabs," and be essentially within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach."

#### **TSD 44.2 Glare**

The driver's work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black or dark gray in color wherever possible to reduce the



reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the driver's area shall be avoided.

#### **TSD 44.3 Visors/Sun Shades**

##### **Front and Side Sun Shade/Visor**

Adjustable sun visor(s) shall be provided for the driver's windshield and the driver's side window. Visors shall be shaped to minimize light leakage between the visor and windshield pillars. Visors shall store out of the way and shall not obstruct airflow from the climate control system or interfere with other equipment, such as the radio handset or the destination control. Deployment of the visors shall not restrict vision of the rearview mirrors. Visor adjustments shall be 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 may be transparent, but shall not allow a visible light transmittance in excess of 10 percent. Visors, when deployed, shall be effective in the driver's field of view at angles more than 5 degrees above the horizontal.

#### **TSD 44.4 Driver's Controls**

Frequently used controls must be in easily accessible locations. These include the door control, kneel control, windshield wiper/washer controls, ramp, and lift and run switch. Any switches and controls necessary for the safe operation of the bus shall be conveniently located and shall provide for ease of operation. They shall be identifiable by shape, touch and permanent markings. Controls also shall be located so that passengers may not easily tamper with control settings.

All panel-mounted switches and controls shall be marked with easily read identifiers. Graphic symbols shall conform to SAE Recommended Practice J2402, "Road Vehicles – Symbols For Controls, Indicators, and Tell Tales," where available and applicable. Color of switches and controls shall be dark with contrasting typography or symbols.

Mechanical switches and controls shall be replaceable, and the wiring at these controls shall be serviceable from a convenient location. Switches, controls and instruments shall be dust- and water-resistant.

#### **TSD 44.5 Normal Bus Operation Instrumentation and Controls**

The following list identifies bus controls used to operate the bus. These controls are either frequently used or critical to the operation of the bus. They shall be located within easy reach of the operator. The operator shall not be required to stand or turn to view or actuate these controls unless specified otherwise.

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

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

On-board displays visible to the operator shall be limited to indicating the status of those functions described herein that are necessary for the operation of the bus. All other indicators needed for diagnostics and their related interface hardware shall be concealed and protected from unauthorized access. Table 3 represents instruments and alarms. The intent of the overall physical layout of the indicators shall be in a logical grouping of systems and severity nature of the fault.

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

**TABLE 6**  
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
Master run switch	Rotary, four-position detent	Side console	Master control for bus, off, day run, night run and clearance ID lights	
Engine start, front	Approved momentary switch	Side console	Activates engine starter motor	
Engine start, rear	Approved momentary switch	Engine compartment	Activates engine starter motor	
Engine run, rear	Three-position toggle switch	Engine compartment	Permits running engine from rear start, normal front run position and off	Amber light
Drive selector	Touch panel switch	Side console	Provides selection of propulsion: forward, reverse and neutral	Gear selection
HVAC	Switch or to control HVAC	Side console	Permits selection of passenger ventilation: off, cool, heat, low fan, high fan or full auto with on/off only	
Driver's ventilation	Rotary, three-position detent	Side console or Dash left wing	Permits supplemental ventilation: fan off, low or high	
Defroster fan	Rotary, three-position detent	Side console or Dash left wing	Permits defroster: fan off, low, medium or high	
Defroster temperature	Variable position	Side console or Dash left wing	Adjusts defroster water flow and temperature	
Windshield wiper	One-variable rotary position operating both wipers	Dash left wing	Variable speed control of left and right windshield wipers	

**TABLE 6**  
Transit Bus Instruments and Alarms

<b>Device</b>	<b>Description</b>	<b>Location</b>	<b>Function</b>	<b>Visual/ Audible</b>
Windshield washer	Push button	Dash left wing	Activates windshield washers	
Dash panel lights	Rotary rheostat or stepping switch	Side Console or Dash left wing	Provides adjustment for light intensity in night run position	
Interior lights	Three-position switch	Side console	Selects mode of passenger compartment lighting: off, on, normal	
Fast idle	Two-position switch	Side console	Selects high idle speed of engine	
WC ramp/kneel enable	Two-position switch <sup>1</sup>	Side console or Dash right wing	Permits operation of ramp and kneel operations at each door remote panel	Amber light
Curb-side Front door ramp/kneel enable	Two-position keyed switch <sup>1</sup>	Front door remote or Dash right wing	Permits ramp and kneel activation from front door area, key required <sup>1</sup>	Amber light
Curb-side Front door ramp	Three-position momentary switch	Right side of steering wheel	Permits deploy and stow of front ramp	Red light
Front kneel	Three-position momentary switch	Front door remote	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator. Ext alarm and Amber light
Curb-side Center, Rear door ramp/kneel enable	Three-position momentary switch	Right side of steering wheel	Permits Bridge Plate activation from driver's seat	Red light
Street-side Front, Rear door ramp/kneel enable	Three-position momentary switch	Right side of steering wheel	Permits Bridge Plate activation from driver's seat	Red light
Rear door ramp	Three-position momentary switch	Rear door remote	Permits deploy and stow of rear ramp	
Rear kneel	Three-position momentary switch	Rear door remote	Permits kneeling activation and raise and normal at rear door remote location	

**TABLE 6**  
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
Stop Requested	Indication a stop is requested	In approved location	Notifies driver with visual cue when a passenger is requesting a stop.	Blue light
Silent alarm	Toggle switch with cover	Side console	Activates emergency radio alarm at dispatch and permits covert microphone.	
Left remote mirror	Four-position toggle type	Side console	Permits two-axis adjustment of left exterior mirror	
Right remote mirror	Four-position toggle type	Side console	Permits two-axis adjustment of right exterior mirror	
Mirror heater	Switch or temperature activated	Side console	Permits heating of outside mirrors when required	
Street side Passenger door control	Front, Center and Rear push button type control	Side console, forward	Permits open/close control of front and rear passenger doors	Red light
Curb side Passenger door control	Front, Center and Rear push button type control	Side console, forward	Permits open/close control of front, center and rear passenger doors	Red light
Curb side Center & Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
Street side Center & Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
Engine shutdown override	Momentary switch with operation protection	Side console	Permits driver to override auto engine shutdown	
Hazard flashers	Two-position switch	Side console or Dash right wing	Activates emergency flashers	Two green lights
Automated Announcement System Logon Device	Automated Announcement System Logon Device	Just above left hand dash accessible to seated driver	Facilitates driver interaction with automated ADA announcement system logon and automatically controls destination signs.	LCD display with visual status and text messages
Farebox interface	Farebox coach operator interface panel	In approved location	Facilitates driver interaction with farebox system, identifies the route.	LCD display

**TABLE 6**  
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
Destination sign interface	Destination sign interface panel	in approved location	Facilitates driver interaction with destination sign system, identifies Route for sign & ADA announcements.	LCD display
Turn signals	Momentary push button (two required) raised from other switches	Left foot panel	Activates left and right turn signals	Two green lights and audible indicator
PA manual	Momentary push button	In approved location	Permits driver to manually activate public address microphone	
Low profile microphone	Low-profile discrete Mounting	Steering column	Permits driver to make announcements with both hands on the wheel and focusing on road conditions	
High beam	Detented push button	In approved location	Permits driver to toggle between low and high beam	Blue light
Parking brake	Pneumatic PPV	Side console or Dash left wing	Permits driver to apply and release parking brake	Red light
Park brake release	Pneumatic PPV	Vertical side of the side console or dash center	Permits driver to push and hold to release brakes	
Hill holder	Two-position momentary switch	Side console	Applies brakes to prevent bus from rolling	
Remote engine speed	Rotary rheostat	Engine compartment	Permits technician to raise and lower engine RPM from engine compartment	
Master door/interlock	Multi-pole toggle, detented	Out of operator's reach	Permits driver override to disable door and brake/throttle interlock	Red light
Warning interlocks deactivated	Red indicator light	Dash panel center	Illuminates to warn drive that interlocks have been deactivated.	Red light
Retarder disable	Multi-pole switch detented	Within reach of Operator or approved location	Permits driver override to disable brake retardation/regeneration	Red light



**TABLE 6**  
Transit Bus Instruments and Alarms

<b>Device</b>	<b>Description</b>	<b>Location</b>	<b>Function</b>	<b>Visual/ Audible</b>
Curb-side Center and Rear doors passenger sensor disable	Multi-pole toggle, detented	In sign compartment or Driver's barrier compartment	Permits driver to override rear door passenger sensing system	
Street-side Front and Rear doors passenger sensor disable	Multi-pole toggle, detented	In sign compartment or Driver's barrier compartment	Permits driver to override rear door passenger sensing system	
Indicator/ alarm test button	Momentary switch or programming <sup>1</sup>	Dash center panel	Permits driver to activate test of sentry, indicators and audible alarms	All visuals and audibles
Auxiliary power	110-volt power receptacle	Approved location	Property to specify what function to supply	N/A
Speedometer	Speedometer, odometer, and diagnostic capability, 5-mile increments	Dash center panel	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Primary and secondary, 5 psi increments	Dash center panel	Visual indication of primary and secondary air systems	Red light and buzzer
Fire detection	Coach operator display	dash center	Indication of fire detection activation location	Buzzer and red light
Curb-side Door obstruction	Sensing of door obstruction	Dash center	Indication of center or rear doors sensitive edge activation	Red light and buzzer
Curb-side Door ajar	Door not properly closed	Property specific or dash center	Indication of center or rear doors not properly closed	Buzzer or alarm and red light
Street-side Door obstruction	Sensing of door obstruction	Dash center	Indication of Front or rear doors sensitive edge activation	Red light and buzzer
Street-side Door ajar	Door not properly closed	Property specific or dash center	Indication of Front or rear doors not properly closed	Buzzer or alarm and red light
Low system air pressure	Sensing low primary and secondary air tank pressure	Dash center	Indication of low air system pressure	Buzzer and red light

**TABLE 6**  
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
Engine coolant indicator	Low coolant indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low coolant condition	Amber light
Hot engine indicator	Coolant temperature indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects hot engine condition and initiates time delay shutdown	Red light
Low engine oil pressure indicator	Engine oil pressure indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low engine oil pressure condition and initiates time-delayed shutdown	Red light
ABS indicator	Detects system status	Dash center	Displays system failure	Amber light
HVAC indicator	Detects system status	Dash center	Displays system failure	Amber or red light
Charging system indicator (12/24 V)	Detect charging system status	Dash center	Detects no charge condition and optionally detects battery high, low, imbalance, no charge condition, and initiates time-delayed shutdown	Red light flashing or solid based on condition
Fuel tank level	Analog gauge, graduated based on fuel type	Dash center	Indication of fuel tank level/pressure	
DEF gauge	Level Indicator	Center dash	Displays level of DEF tank and indicates with warning light when low	N/A
Turntable	Detects Status	Dash Center	Warning indication for hinge locking	Audible and amber warning and red light if locked
Turntable	Interlock momentary switch	Side console	Momentarily release interlock brakes due to over angled condition	

## **TSD 44.6 Driver Foot Controls**

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

### **TSD 44.6.1 Pedal Angle**

The vertical angle of the accelerator and brake pedals shall be determined from a horizontal plane regardless of the slope of the cab floor. The accelerator and brake pedals shall be positioned at an angle of 37 to 50 degrees at the point of initiation of contact and extend downward to an angle of 10 to 18 degrees at full throttle.

The location of the brake and accelerator pedals shall be determined by the manufacturer, based on space needs, visibility, lower edge of windshield, and vertical H-point.

### **TSD 44.6.2 Pedal Dimensions and Position**

The floor-mounted accelerator pedal shall be 10 to 12 in. long and 3 to 4 in. wide. Clearance around the pedal must allow for no interference precluding operation.

#### **1 to 2 in. Between Brake and Accelerator Pedals**

The accelerator and brake pedals shall be positioned such that the spacing between them, measured at the heel of the pedals, is between 1 and 2 in. Both pedals should be located approximately on the same plane coincident to the surface of the pedals.

## **TSD 44.7 Brake and Accelerator Pedals**

### **Brake Pedal**

Non-adjustable brake pedal.

## **TSD 44.8 Driver Foot Switches**

### **Floor-Mounted Foot Control Platform**

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

### **Turn Signal Controls**

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

### **Foot Switch Control**

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

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

**Other Floor-Mounted Controls**

- silent alarm
- PA system

Steering wheel mounted (self-canceling)

***TSD 45. Driver's Amenities***

**TSD 45.1 Coat Hanger**

N/A

**TSD 45.2 Drink Holder**

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

**TSD 45.3 Storage Box**

An enclosed driver storage area shall be provided with a positive latching door and thumb lock. The minimum size is 2750 cubic in.

***TSD 46. Windshield Wipers and Washers***

**TSD 46.1 Windshield Wipers**

The bus shall be equipped with a windshield wiper for each half of the windshield. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. For two-piece windshields, both wipers shall park along the center edges of the windshield glass. For single-piece windshields, wipers shall park along the bottom edge of the windshield. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service. The fastener that secures the wiper arm to the drive mechanism shall be corrosion-resistant.

**Wiper Powered by Compressed Air**

If powered by air, exhaust from the wiper motors shall be muffled or piped under the floor of the bus.

Dual controls for air-operated system.

**Intermittent Wiper with Variable Control**

A variable-speed feature shall be provided to allow adjustment of wiper speed for each side of the windshield between approximately five (5) and twenty-five (25) cycles per minute.

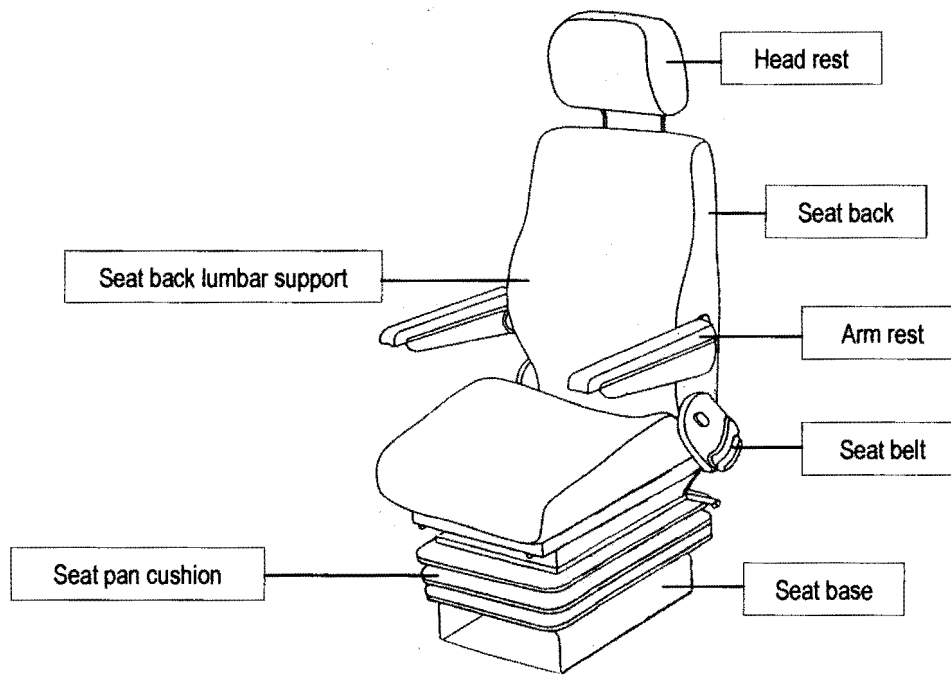
**TSD 46.2 Windshield Washers**

The windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area.

The windshield washer system shall have a minimum 3-gallon reservoir, located for easy refilling from outside of the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

**TSD 47. Driver's Seat****FIGURE 6**

Driver's Seat

**TSD 47.1 Dimensions**

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

**TSD 47.1.1 Seat Pan Cushion Length**

Measurement shall be from the front edge of the seat pan to the rear at its intersection with the seat back. The adjustment of the seat pan length shall be no less than 16.5 in. at its minimum length and no more than 20.5 in. at its maximum length.

**TSD 47.1.2 Seat Pan Cushion Height**

Measurement shall be from the cab floor to the top of the level seat at its center midpoint. The seat shall adjust in height from a minimum of 14 in., with a minimum 6 in. vertical range of adjustment.

**TSD 47.1.3 Seat Pan Cushion Slope**

Measurement is the slope of the plane created by connecting the two high points of the seat, one at the rear of the seat at its intersection with the seat back and the other at the front of the seat just before it waterfalls downward at the edge. The slope can be measured using an inclinometer and shall be stated in degrees of incline relative to the horizontal plane (0 degrees). The seat pan shall adjust in its slope from no less than plus 12 degrees (rearward "bucket seat" incline), to no less than minus 5 degrees (forward slope).

**TSD 47.1.4 Seat Base Fore/Aft Adjustment**

Measurement is the horizontal distance from the heel point to the front edge of the seat. The minimum and maximum distances shall be measured from the front edge of the seat when it



is adjusted to its minimum seat pan depth (approximately 15 in.). On all low-floor buses, the seat-base shall travel horizontally a minimum of 9 in. It shall adjust no closer to the heel point than 6 in. On all high-floor buses, the seat base shall travel a minimum of 9 in. and adjust no closer to the heel-point than 6 in.

#### **TSD 47.1.5 Seat Pan Cushion Width**

Measurement is the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 in. across at the front edge of the seat cushion and 20 to 23 in. across at the side bolsters.

#### **TSD 47.1.6 Seat Suspension**

The driver's seat shall be appropriately dampened to support a minimum weight of 380 lbs. The suspension shall be capable of dampening adjustment in both directions.

Rubber snubbers shall be provided to prevent metal-to-metal contact.

#### **TSD 47.1.7 Seat Back**

##### **Width**

Measurement is the distance between the outermost points of the front of the seat back, at or near its midpoint in height. The seat back width shall be no less than 19 in. Seat back will include dual recliner gears on both sides of the seat.

##### **Height**

Standard height seat back.

#### **TSD 47.1.8 Headrests**

Adjustable headrest.

#### **TSD 47.1.9 Seat Back Lumbar Support**

Measurement is from the bottom of the seat back at its intersection with the seat pan to the top of the lumbar cushioning. The seat back shall provide adjustable depth lumbar back support with three individual operating lumbar cells within a minimum range of 7 to 11 in.

#### **TSD 47.1.10 Seat Back Angle Adjustment**

The seat back angle shall be measured relative to a level seat pan, where 90 degrees is the upright position and 90 degrees-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 degrees (upright) to at least 105 degrees (reclined), with infinite adjustment in between.

#### **TSD 47.2 Seat Belt**

The belt assembly should be an auto-locking retractor (ALR). All seat belts should be stored in automatic retractors. The belts shall be mounted to the seat frame so that the driver may adjust the seat without resetting the seat belt.

The seat and seat belt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210.

**Lap and Shoulder (Three-Point) Seat Belt**

Seat belts shall be provided across the driver's lap and diagonally across the driver's chest. The driver shall be able to use both belts by connecting a single buckle on the right side of the seat cushion. 3-pt seatbelts must be emergency locking retractor (ELR) in design.

**Lap Belt Length**

**72 in. with Extension**

The lap belt assembly shall be 72 in. in length with an 8-in. extension

**TSD 47.3 Adjustable Armrest**

There should be no armrests.

**TSD 47.4 Seat Control Locations**

While seated, the driver shall be able to make seat adjustments by hand without complexity, excessive effort or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

**TSD 47.5 Seat Structure and Materials**

Cushions shall be fully padded with at least 3 in. of materials in the seating areas at the bottom and back.

**Cushion Materials**

Black vinyl. Closed-cell polyurethane (FMVSS 302).

**TSD 47.6 Pedestal**

Stainless steel.

**TSD 47.7 Seat Options**

USSC 9100 ALX/3PT or approved equal.

**TSD 47.8 Mirrors**

**TSD 47.8.1 Exterior Mirrors**

The bus shall be equipped with a corrosion-resistant, outside rearview mirrors mounted with stable supports to minimize vibration. Mirrors shall be firmly attached to the bus to minimize vibration and to prevent loss of adjustment with a breakaway mounting system. Mirrors shall permit the driver to view the roadway along the sides of the bus, including the rear wheels. Mirrors should be positioned to prevent blind spots.

Mirrors shall retract or fold sufficiently to allow bus washing operations but avoid contact with windshield.

Spring loaded mirror heads auto return.

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

Exterior mirrors shall contain LED turn signal indicators.

### **Curbside Mirrors**

The curbside rearview mirror shall be mounted so that its lower edge is no less than 76 in. above the street surface. A lower mount may be required due to requested mirror configuration requests

### **Remote Adjustment of Curbside Mirror**

The driver shall be able to adjust the curbside mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

### **Street-Side Mirrors**

### **Remote Adjustment of Curbside Mirror**

The driver shall be able to adjust the street-side mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

### **TSD 47.8.2 Interior Mirrors**

Mirrors shall be provided for the driver to observe passengers throughout the bus without leaving the seat and without shoulder movement. The driver shall be able to observe passengers in the front/entrance and rear/exit areas, anywhere in the aisle, and in the rear seats.

## **WINDOWS**

### ***TSD 48. General***

A minimum of 10,000 sq. in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

### ***TSD 49. Windshield***

The windshield shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of 14 degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ ft. high no more than 2 ft. in front of the bus. The horizontal view shall be a minimum of 90 degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90-degree requirement, provided that the divider does not exceed a 3-degree angle in the operator's field of view. Windshield pillars shall not exceed 10 degrees of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshields shall not be used. Winglets may be bonded.

### **TSD 49.1 Glazing**

The windshield glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673. Lace-seal

### **Shaded Band**

The upper portion of the windshield above the driver's field of view shall have a dark, shaded band with a minimum luminous transmittance of 5 percent when tested in accordance to ASTM D-1003.

**TSD 50. Driver's Side Window**

The driver's side window shall be the sliding type, requiring only the rear half of sash to latch upon closing, and shall open sufficiently to permit the seated operator to easily adjust the street-side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. This window section shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall have a single-density tint.

The driver's view, perpendicular through operator's side window glazing, should extend a minimum of 33 in. (840 mm) to the rear of the heel point on the accelerator, and in any case must accommodate a 95th percentile male operator. The view through the glazing at the front of the assembly should begin not more than 26 in. (560 mm) above the operator's floor to ensure visibility of an under-mounted convex mirror. Driver's window construction shall maximize ability for full opening of the window.

The driver window glazing material shall be ThermoGuard Blue Spruce 70. The glazing shall be 6 mm laminated heat-treated safety. The material shall conform to the requirements of ANSI Z26.1 and the Recommended Practices defined in SAJ673. The glass tint shall be blue with 70% LT or greater and comply with AS2 DOT requirements, blocking 99% of the UV and allowing less than 3–6% of the infrared heat to pass through the pane.

**Hidden Frame (Flush "Euro-look") Driver's Side Window**

- full slider
- non-egress

**TSD 51. Side Windows****TSD 51.1 Configuration**

Side windows shall not be bonded in place, but shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent. All aluminum and steel material will be treated to prevent corrosion.

**TSD 51.2 Emergency Exit (Egress) Configuration****Minimum Egress**

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

**Standard Passenger Side Window Configurations**

- hidden frame (flush "Euro-look")
  - full fixed

**Hidden Frame (Seamless)**

- full fixed

**TSD 51.3 Configuration****Fixed Side Windows**

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

## **TSD 51.4 Materials**

### **Safety Glass Glazing Panels**

The side window glazing material shall be ThermoGuard Blue Spruce 70. The glazing shall be 6 mm laminated heat-treated safety glass. The material shall conform to the requirements of ANSI Z26.1 and the Recommended Practices defined in SAJ673. The glass tint shall be blue with 70% LT or greater and comply with AS2 DOT requirements, blocking 99% of the UV and allowing less than 3–6% of the infrared heat to pass through the pane.

### **Graffiti Shield Coating**

The interior side windows of each bus shall be delivered with 3M™ 4- Layer Graffiti Film affixed to each window.

## **TSD 51.5 Rear Window**

No requirement for rear window.

## **HEATING, VENTILATING AND AIR CONDITIONING**

### ***TSD 52. Capacity and Performance***

The HVAC climate control system shall be capable of controlling the temperature and maintaining the humidity levels of the interior of the bus as defined in the following paragraphs.

### **Allow Rear-Mounted HVAC Unit**

The HVAC unit will be rear-mounted Thermo King.

Fully AC high-voltage electric-driven A/C system with full hermetic AC compressor, condenser fan, evaporator blower motors and brushless AC generators.

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

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

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

System capacity testing, including pull-down/warm-up, stabilization and profile, shall be conducted in accordance to the APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System."

The recommended locations of temperature probes are only guidelines and may require slight modifications to address actual bus design. Care must be taken to avoid placement of sensing devices in the immediate path of an air duct outlet. In general, the locations are intended to accurately represent the interior passenger area.



Additional testing shall be performed as necessary to ensure compliance to performance requirements stated herein.

### **Capacity and Performance Requirements**

The air-conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 110 to 90 °F in less than 20 minutes after engine start-up. Engine temperature shall be within the normal operating range at the time of start-up of the cool-down test, and the engine speed shall be limited to fast idle, which may be activated by a driver-controlled device. During the cool-down period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 in. from the surface of the coil, shall be less than 45 °F above the condenser inlet air temperature. The appropriate solar load as recommended in the APTA "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System," representing 4 p.m. on August 21, shall be used. There shall be no passengers on board, and the doors and windows shall be closed.

### **R407C**

The air conditioning system shall meet these performance requirements using R407C.

### ***TSD 53. Controls and Temperature Uniformity***

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

Hot engine coolant water shall be delivered to the HVAC system driver's defroster/heater and other heater cores by means of an auxiliary coolant pump, sized for the required flow, which is brushless and seal less having a minimum maintenance free service life for both the brushless motor and the pump of at least 40,000 hours at full power.

### **Fully Automatic Climate Control System**

The climate control system shall be fully automatic and control the interior average temperature to within  $\pm 2$  °F of specified temperature control set-point.

### **Single Control Set Point at 70 °F**

The temperature control set-point for the system shall be 70 °F.

Interior temperature distribution shall be uniform to the extent practicable to prevent hot and/or cold spots. After stabilization with doors closed, the temperatures between any two points in the passenger compartment in the same vertical plane, and 6 to 72 in. above the floor, shall not vary by more than 5 °F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than  $\pm 5$  °F from the front to the rear from the average temperature determined in accordance with APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." Variations of greater than  $\pm 5$  °F will be allowed for limited, localized areas provided the majority of the measured temperatures fall within the specified requirement.

### ***TSD 54. Air Flow***

#### **TSD 54.1 Passenger Area**

The cooling mode of the interior climate control system shall introduce air into the bus at or near the ceiling height at a minimum rate of 25 cubic ft per minute (cfm) per passenger based on the standard configuration bus carrying a number of passengers equal to 150 percent of the seated load. Airflow shall be evenly distributed throughout the bus, with air velocity not exceeding 100 ft per minute on

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

Airflow may be reduced to 15 cfm per passenger (150 percent of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure at least 70 °F air outlet temperature. The heating air outlet temperature shall not exceed 120 °F under any normal operating conditions.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements.

### **No "Fresh Air" Requirements**

#### **TSD 54.2 Driver's Area**

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

#### **TSD 54.3 Controls for the Climate Control System (CCS)**

The controls for the driver's compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- The heat/defrost system fan shall be controlled by a separate switch that has an "off" position and at least two positions for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. If the fans are approved by the City, an "on-off" switch shall be located to the right of or near the main defroster switch.
- A manually operated control valve shall control the coolant flow through the heater core.
- If a cable-operated manual control valve is used, the cable length shall be kept to a minimum to reduce cable seizing. Heater water control valves shall be "positive" type, closed or open. The method of operating remote valves shall require the concurrence of the City project manager.

#### **TSD 54.4 Driver's Compartment Requirements**

A separate heating, ventilation and defroster system for the driver's area shall be provided and shall be controlled by the driver. The system shall meet the following requirements:

- The heater and defroster system shall provide heating for the driver and heated air to completely defrost and defog the windshield, driver's side window, and the front door glasses in all operating conditions. Fan(s) shall be able to draw air from the bus body interior and/or the exterior through a control device and pass it through the heater core to the defroster system and over the driver's feet. A minimum capacity of 100 cfm shall be provided. The driver shall have complete control of the heat and fresh airflow for the driver's area.

- The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and shall be free of sharp edges that can catch clothes during normal daily cleaning. The system shall be such that foreign objects such as coins or tickets cannot fall into the defroster air outlets. Adjustable ball vents or louvers shall be provided at the left of the driver's position to allow direction of air onto the side windows.

A ventilation system shall be provided to ensure driver comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the driver from the normal driving position. Decals shall be provided, indicating "operating instructions" and "open" and "closed" positions. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

#### **TSD 54.5 Driver's Cooling**

##### **Separate Dedicated Evaporator**

Using a separate, dedicated evaporator, the Climate Control System shall be designed to maintain the driver's compartment temperatures within the range specified for the passenger compartment. The unit shall operate when the climate control switch is in the "Cool" position. It shall have a separate thermostatic control.

#### **OR**

A separate fan unit shall provide 100 cfm of air to the driver's area through directionally adjustable nozzles and an infinitely variable fan control, both of which shall be located above and ahead of the driver.

#### ***TSD 55. Air Filtration***

Air shall be filtered before discharge into the passenger compartment. The filter shall meet the ANSI/ASHRAE 52.1 requirement for 5 percent or better atmospheric dust spot efficiency, 50 percent weight arrestance, and a minimum dust holding capacity of 120 g per 1000 cfm cell. Air filters shall be easily removable for service.

Air filters shall be of disposable type.

#### ***TSD 56. Roof Ventilators***

Two roof ventilators shall be provided in the roof of the bus, one approximately over or just forward of the front axle and the other approximately over the rear axle.

Each ventilator shall be easily opened and closed manually. When open with the bus in motion, this ventilator shall provide fresh air inside the bus. The ventilator shall cover an opening area no less than 425 sq. in. and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 in., or with all four edges raised simultaneously to a height of no less than 3½ in. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) shall be sealed to prevent entry of water when closed.

#### ***TSD 57. Maintainability***

Manually controlled shut-off valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, self-sealing couplings utilizing O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shut-off valves may be provided in lieu of self-sealing couplings. The condenser shall be

located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or to discharge air into any other system of the bus. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris. HVAC components located within 6 in. of floor level shall be constructed to resist damage and corrosion.

High and low refrigerant pressure electronic gauges to be located in the return air area.

***TSD 58. Entrance/exit area heating***

No requirements for entrance/exit area heating.

***TSD 59. Floor-Level Heating***

No requirements for floor-level heating.

**EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING**

***TSD 60. Design***

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

Exterior panels shall be sufficiently stiff to minimize vibration, drumming or flexing while the bus is in service. When panels are lapped, the upper and forward panels shall act as a watershed. However, if entry of moisture into the interior of the vehicle is prevented by other means, then rear cap panels may be lapped otherwise. The windows, hatches and doors shall be able to be sealed. Accumulation of spray and splash generated by the bus's wheels shall be minimized on windows and mirrors.

***TSD 60.1 Materials***

Body materials shall be selected and the body fabricated to reduce maintenance, extend durability and provide consistency of appearance throughout the service life of the bus. Detailing shall be kept simple, and add-on devices and trim shall be minimized and integrated into the basic design.

No requirement for protection against graffiti/vandalism for body material surfaces.

***TSD 60.2 Roof-Mounted Equipment***

A non-skid, clearly marked walkway or steps shall be incorporated on the roof to provide access to equipment without damaging any system or bus paneling.

***TSD 61. Pedestrian Safety***

Exterior protrusions along the side and front of the bus greater than ½ in. and within 80 in. of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors, cameras and required lights and reflectors are exempt from the protrusion requirement. Advertising frames shall protrude no more than ⅜ in. from the body surface. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize toeholds or handholds.

Exterior protrusions shall not cause a line-of-sight blockage for the driver.



## ***TSD 62. Repair and Replacement***

### **TSD 62.1 Side Body Panels**

Structural elements supporting exterior body panels shall allow side body panels below the windows to be repaired in lengths not greater than 12.5 ft.

Standard attachment of side body panels.

## ***TSD 63. Rain Gutters***

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and driver's side window. When the bus is decelerated, the gutters shall not drain onto the windshield, driver's side window or door boarding area. Cross-sections of the gutters shall be adequate for proper operation.

## ***TSD 64. License Plate Provisions***

Provisions shall be made to mount a standard-size U.S./Canada license plate per SAE J686 on the rear of the bus. These provisions shall direct-mount or recess the license plate so that it can be cleaned by automatic bus-washing equipment without being caught by the brushes. The rear license plate provision shall be illuminated per SAE J587.

### **TSD 64.1 Rub rails**

No requirement for rub rails.

## ***TSD 65. Fender Skirts***

Designed to cover the upper portions of the wheels shall be installed on the center and rear wheels and match the color of the bus body.

## ***TSD 66 Splash Aprons***

### **Standard Splash Aprons**

Splash aprons, composed of ¼ in. minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and protect underfloor components. The splash aprons shall extend downward to within 6 in. off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Splash apron shall be installed as necessary to protect the wheelchair loading device from road splash. Other splash aprons shall be installed where necessary to protect bus equipment.

## ***TSD 67. Service Compartments and Access Doors***

### **TSD 67.1 Access Doors**

Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the engine coolant, engine lubricant and transmission fluid. Access openings shall be sized for easy performance of tasks within the compartment, including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be retained in the open



position by props or counterbalancing with over-center or gas-filled springs with safety props and shall be easily operable by one person. Springs and hinges shall be corrosion resistant. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Access doors, when opened, shall not restrict access for servicing other components or systems.

If precluded by design, the manufacturer shall provide door design information specifying how the requirements are met.

A separate door will be required that will allow for access to the oil dipstick area.

## **TSD 67.2 Access Door Latch/Locks**

### **Requirement for Latches on Access Doors**

Access doors larger than 100 sq. in. in area shall be equipped with corrosion-resistant flush-mounted latches or locks except for coolant and fuel fill access doors. All such access doors that require a tool to open shall be standardized throughout the vehicle and will require a nominal 5/16 in. square male tool to open or lock.

## ***TSD 68. Bumpers***

### **TSD 68.1 Location**

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in.,  $\pm 2$  in., above the ground. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

### **TSD 68.2 Front Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 5 mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus's longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs parallel to the longitudinal centerline of the bus. It shall protect the bus from damage as a result of 5.5 mph impacts into the corners at a 30-degree angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

### **TSD 68.3 Rear Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 2 mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 ft wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 in. high, and at accelerations up to 2 mph/sec. The rear bumper shall protect the bus, when impacted anywhere along its width by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs, at 4 mph parallel to or up to a 30-degree angle to, the longitudinal centerline of the bus. The rear bumper shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall not require service or maintenance in normal operation during the

service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

#### **TSD 68.4 Bumper Material**

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. Visible surfaces shall be match the color of the bus. These bumper qualities shall be sustained throughout the service life of the bus.

### ***TSD 69. Finish and Color***

#### **TSD 69.1 Appearance**

All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surfaces to be painted shall be properly prepared as required by the paint system Supplier prior to application of paint to assure a proper bond between the basic surface and successive coats of original paint for the service life of the bus. Drilled holes and cutouts in exterior surfaces shall be made prior to cleaning, priming and painting, where possible, to prevent corrosion. The bus shall be completely painted prior to installation of exterior lights, windows, mirrors and other items that are applied to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.

Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- blisters or bubbles appearing in the topcoat film
- chips, scratches, or gouges of the surface finish
- cracks in the paint film
- craters where paint failed to cover due to surface contamination
- overspray
- peeling
- runs or sags from excessive flow and failure to adhere uniformly to the surface
- chemical stains and water spots
- dry patch due to incorrect mixing of paint activators
- buffing swirls

All exterior finished surfaces shall be impervious to diesel fuel, gasoline and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals.

Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer adhesion tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft.-lbs. The bus manufacturer shall supply test samples of the exterior surface for each step of the painting process that may be subject to adhesion testing per ASTM G4541-87 and ASTM D4145-85. ASTM D4541-93 may be used for inspection testing during assembly of the vehicle.

Standard Contractor exterior paint finish quality.

Water Based Basecoat/Clear Coat paint system.

#### **TSD 69.2 Color**

The base color of the bus, wheels and wheel covers is to be silver metallic. Additional details about other markings will be approved by the City of Albuquerque Transit Department prior to production of the buses.

### ***TSD 70. Decals, Numbering and Signing***

Monograms, numbers and other special signing shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade-, chip- and peel-resistant. They may be painted signs, decals or pressure-sensitive appliques, and they shall all incorporate reflective properties. All decals shall be installed per the decal Supplier recommendations. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part, Subpart B, 38.27.

**NOTE:** Schematic for all decals and numbering will be provided upon award of contract. All decals and signs will be in both English and Spanish.

#### **TSD 70.1 Passenger Information**

ADA priority seating signs as required and defined by 49 CFR, Part 38.27 shall be provided to identify the seats designated for passengers with disabilities.

Requirements for a public information system in accordance with 49 CFR, Part 38.35 shall be provided.

### ***TSD 71. Exterior Lighting***

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

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Commercially available LED-type lamps shall be utilized at all exterior lamp locations. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the bus shall be visible from behind when the engine service doors are opened. Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer. Front marker (clearance) lights along with lights located on the roof and sides of the bus shall have protective shields or be of the flush mount type to protect the lens against minor impacts.

#### **Standard Lamps**

All LED lamps shall be standard installation of the OEM. The entire assembly shall be specifically coated to protect the light from chemical and abrasion degradation.

#### **Standard Size**

Size of LED lamps used for tail, brake and turn signal lamps shall be standard installation of OEM.

#### **TSD 71.1 Backup Light/Alarm**

Visible and audible warnings shall inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE Standard J593. Audible reverse operation warning shall conform to SAE Recommended Practice J994 Type C or D.

#### **TSD 71.2 Doorway Lighting**

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

### **TSD 71.3 Turn Signals**

#### **Standard Turn Signals**

Turn-signal lights shall be provided on the front, rear, curb and street sides of the bus in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. Turn signals shall also be built into the exterior of the curb and street side mirrors.

### **TSD 71.4 Headlights**

Roved headlamps shall be designed for replacement without removing the headlamp bezel.

#### **Daytime Running Lights**

Headlamps shall incorporate a daytime running light feature.

#### **LED/Halogen**

Headlamps shall be LED/halogen, sealed beam.

### **TSD 71.5 Brake Lights**

Brake lights shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable.

#### **High and Center Mount Red Brake Lamp**

Bus shall include red, high and center mount brake lamp(s) along the backside of the bus in addition to the lower brake lamps required under FMVSS 108. The high and center mount brake lamp(s) shall illuminate steady with brake application.

### **TSD 71.6 Service Area Lighting (Interior and Exterior)**

LED lamps shall be provided in the engine and all other compartments where service may be required to generally illuminate the area for night emergency repairs or adjustments. These service areas shall include, but not be limited to, the engine compartment, the communication box, junction/apparatus panels and passenger door operator compartments. Lighting shall be adequate to light the space of the service areas to levels needed to complete typical emergency repairs and adjustments. The service area lamps shall be suitable for the environment in which they are mounted.

Engine compartment lamps shall be controlled by a switch mounted near the rear start controls. All other service area lamps shall be controlled by switches mounted on or convenient to the lamp assemblies. Power to the service area lighting shall be programmable. Power shall latch on with activation of the switch and shall be automatically discontinued (timed out) after 30 minutes to prevent damage caused by inadvertently leaving the service area lighting switch in the on position after repairs are made.

## ***INTERIOR PANELS AND FINISHES***

### ***TSD 72. General Requirements***

Materials shall be selected on the basis of maintenance, durability, appearance, safety, flammability and tactile qualities. Materials shall be strong enough to resist everyday abuse and be vandalism and corrosion resistant. Trim and attachment details shall be kept simple and unobtrusive. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 in. below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the coach is parked on a level surface. Any components and other electrical components within close proximity to these surfaces shall also be resistant to this cleaning method.

Requirements for additional anti-graffiti/vandalism treatments for interior surfaces.

### ***TSD 73. Interior Panels***

Panels shall be easily replaceable and tamper-resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Individual trim panels and parts shall be interchangeable to the extent practicable.

Interior panel required to meet FMVSS 302.

#### **TSD 73.1 Driver Area Barrier**

A barrier or bulkhead will be located behind the driver's seat to separate the driver from the street-side front passenger seat. The Electronics Cabinet shall be incorporated into the Driver Area Barrier. This barrier shall minimize glare and reflections in the windshield directly in front of the barrier, and from interior lighting during night operation. Location and shape must permit full seat travel and reclining possibilities that can accommodate the shoulders of a 95th-percentile male. The barrier shall have a side return and stanchion to prevent passenger from reaching the driver by standing behind the driver's seat. The lower area between the seat and panel must be accessible to the driver. The barrier must be strong enough in conjunction with entire partition assembly for mounting of such equipment as flare kits, fire extinguishers (1.2 kg), microcomputer, public address amplifier, etc. Dark or black panels are preferred behind the driver's head. The panel should be isolated for noise control and attached with rubber grommets. Includes sufficient clearance for access by a wheelchair.

#### **TSD 73.2 Modesty Panels**

Sturdy divider panels constructed of durable, unpainted, corrosion-resistant material complementing the interior shall be provided to act as both a physical and visual barrier for seated passengers.

Design and installation of modesty panels located in front of forward-facing seats shall include a handhold or grab handle along its top edge. These dividers shall be mounted on the sidewall and shall project toward the aisle no farther than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend from at least the window opening of the side windows, and those forward of transverse seats shall extend downward to 1 and 1½ in. above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the doorways shall provide no less than a 2½ in. clearance between the modesty panel and a fully open, inward opening door, or the path of a deploying flip-out ramp to protect passengers from being pinched. Modesty panels installed at doorways shall be equipped with grab rails if passengers assist are not provided by other means.

The modesty panel and its mounting shall withstand a static force of 250 lbs applied to a 4 × 4 in. area in the center of the panel without permanent visible deformation.

Clear non-glass panel from above the modesty panel to the top of the daylight opening and attached to the stanchion.



**TSD 73.3 Front End**

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the driver's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing at the front of the standee line area of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the driver's compartment shall be formed metal or composite material. Composite dash panels shall be reinforced as necessary, vandal-resistant and replaceable. All colored, painted and plated parts forward of the driver's barrier shall be finished with a surface that reduces glare. Any mounted equipment must have provision to support the weight of equipment.

**TSD 73.4 Rear Bulkhead**

The rear bulkhead and rear interior surfaces shall be material suitable for exterior skin; painted and finished to exterior quality; or paneled with melamine-type material, composite, scratch-resistant plastic and trimmed with stainless steel.

The rear bulkhead paneling shall be contoured to fit the ceiling, side walls and seat backs so that any litter or trash will tend to fall to the floor or seating surface when the bus is on a level surface. Any air vents in this area shall be louvered to reduce airflow noise and to reduce the probability of trash or liter being thrown or drawn through the grille. If it is necessary to remove the panel to service components located on the rear bulkhead, the panel shall be hinged or shall be able to be easily removed and replaced. Grilles where access to or adjustment of equipment is required shall be heavy-duty and designed to minimize damage and limit unauthorized access.

**TSD 73.5 Headlining**

Ceiling panels shall be made of durable, corrosion resistant, easily cleanable material. Headlining shall be supported to prevent buckling, drumming or flexing and shall be secured without loose edges. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trim strips, as required to make the edges tamperproof, shall be stainless steel, aluminum or plastic, colored to complement the ceiling material. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening.

**TSD 73.6 Fastening**

Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Fasteners should be corrosion resistant. Panels and fasteners shall not be easily removable by passengers. Exposed interior fasteners should be minimized, and where required shall be tamper-resistant.

**TSD 73.7 Insulation**

Any insulation material used between the inner and outer panels shall minimize the entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the bus. Any insulation material used inside the engine compartment shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations.

The combination of inner and outer panels on the sides, roof, wheel wells and ends of the bus, and any material used between these panels, shall provide a thermal insulation sufficient to meet the interior temperature requirements. The bus body shall be thoroughly sealed so that the driver or passengers cannot feel drafts during normal operations with the passenger doors closed.

### **FMVSS 302**

Insulation shall meet the requirements of FMVSS 302.

### **TSD 73.8 Floor Covering**

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

### **Additional Requirements**

Any areas on the floor that are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked.

The floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

A one-piece center strip shall extend from the vertical wall of the rear settee between the aisle sides of transverse seats to the standee line. If the floor is of a bi-level construction, then the center strip shall be one piece at each level. The covering between the center strip and the wheel housings may be separate pieces. At the rear door, however, a separate strip as wide as the door shall extend from the center strip to the outboard edge of the rear/exit area.

The floor under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall in a fully sealed butt joint or extend to the top of the cove.

### **TSD 73.9 Interior Lighting**

The lights shall be LED lights. The light source shall be located to minimize windshield glare, with distribution of the light focused primarily on the passengers' reading plane while casting sufficient light onto the advertising display. The lighting system may be designed to form part of or the entire air distribution duct.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. Lenses shall be sealed to inhibit incursion of dust and insects yet be easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels. If necessary, the entire light fixture shall be hinged.

### **TSD 73.10 Passenger**

#### **Dimming Second Row Lights**

To help eliminate windshield reflection on suburban roads where street lighting is at a low level, the second light on each side, when "night run" or "night park" is selected, shall be controlled by the toggle switch; off in "off" and on in "normal." These lights shall be turned on at any time if the toggle switch is in the "on" position.

The interior lighting design shall require the approval of the City.

LED lights.

### **First Light Modules Dim/Extinguish When Front Door is Closed**

When the master switch is in the "run" or "night/run" mode, the first light module on each side of the coach shall automatically extinguish or dim when the front door is in the closed position and illuminate when the door is opened. This shall be accomplished through the use of a ballast specifically designed for this type application without diminishing the life of the fluorescent tubes.

### **TSD 73.11 Driver Area**

The driver's area shall have a light to provide general illumination, and it shall illuminate the half of the steering wheel nearest the driver to a level of 5 to 10 foot-candles.

### **TSD 73.12 Seating Areas**

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

### **TSD 73.13 Vestibules/Doors**

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

### **TSD 73.14 Step Lighting**

Step lighting for the intermediate steps between lower and upper floor levels shall be a minimum of 4 foot-candles and shall illuminate in all engine run positions. The step lighting shall be low-profile to minimize tripping and snagging hazards for passengers and shall be shielded as necessary to protect passengers' eyes from glare.

### **TSD 73.15 Ramp Lighting**

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

### **TSD 73.16 Turntable Lighting**

Lighting in the turntable can be reduced to 7 foot-candles.

### **TSD 73.17 Farebox Lighting**

A light fixture shall be mounted in the ceiling above the farebox location. The fixture shall be capable of projecting a concentrated beam of light on the farebox. This light will automatically come on whenever the front doors are opened and the run switch is in the "night run" or "night park" position.

## ***TSD 74. Fare Collection***

The fare collection system is to be completely installed at the factory. Location of the fare collection device shall not restrict traffic in the vestibule, including wheelchairs if a front door loading device is used, and shall allow the driver to easily reach the farebox controls and to view the fare register. The fare box shall not restrict access to the driver area, shall not restrict operation of driver controls and shall not — either by itself or in combination with stanchions, transfer mounting, cutting and punching equipment, or route destination signs — restrict the driver's field of view per SAE Recommended Practice J1050. The location and

mounting of the fare collection device shall allow use, without restriction, by passengers. The fare box location shall permit accessibility to the vault for easy manual removal or attachment of suction devices. Meters and counters on the fare box shall be readable on a daily basis. The floor under the fare box shall be reinforced as necessary to provide a sturdy mounting platform and to prevent shaking of the fare box.

The Albuquerque Transit Department will provide a template so that the fare box and be mounted at the proper angle.

Odyssey by Gen Fare (price with and without smartcard options). It shall contain the largest cashbox available and is not to accept tokens.

#### ***TSD 75. Interior Access Panels and Doors***

Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's way. Panels shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover.

#### **Access Doors with Locks**

Access doors shall be secured with locks. The locks shall be standardized so that only one tool is required to open access doors on the bus.

#### **TSD 75.1 Floor Panels**

Access openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring material at or around access openings shall be flush with the floor and shall be edge-bound with stainless steel or another material that is acceptable to the City to prevent the edges from coming loose. Access openings shall be asymmetrical so that reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

The number of special fastener tools required for panel and access door fasteners shall be minimized.

### ***PASSENGER ACCOMMODATIONS***

#### ***TSD 76. Passenger Seating***

#### **TSD 76.1 Arrangements and Seat Style**

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance to the following requirements allowing for a minimum of **44** seated passengers. There will be no seating in the Bicycle Area. See details in TS 76.10.

Note: The City recognizes that ramp location, foot room, hip-to-knee room, doorway type, width, seat construction, floor level type, seat spacing requirements, ramp or lift, number of wheelchair positions, etc. ultimately affect seating capacity and layout.

#### **Forward-Facing Seat Configuration**

Passenger seats shall be arranged in a transverse, forward-facing configuration, except at the wheel housings 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, the accessible path from center doors to wheelchair securement areas, and platforms (such as for fuel tank storage space).



### **TSD 76.2 Rearward Facing Seats**

Rearward facing seats not allowed.

**TSD 76.3 Turntable Seating** – There shall be seating for 4 passengers inside of the turntable, compatible with the rest of the seating on board.

### **TSD 76.4 Passenger Seat Specification Stainless (Aries 4MA)**

Passenger seating shall be either 4ONE Aries 4MA, or American Seating Insight. Seating shall meet or exceed all Federal Procurement Guidelines (White Book) standards and requirements and meet the following specifications.

**GENERAL:** The seat shall be ergonomically designed and shaped to provide optimal lumbar, kidney area, and buttocks support. Seats for the various seating arrangements shall have the dimensions shown in the following figure.

**LOGO:** Albuquerque Transit Department will provide a branding logo to appear on seatbacks.

**USB CHARGING PORTS:** A USB charging port will be available for use at each passenger seat. Each port will have an LED that when lit will indicate power is available to the port. The exact location must be approved in advance in a location that cannot be in a place where it interferes with the cleaning of the bus.

### **OPTIONAL SEAT WIDTH OF 37"**

The thickness of the transverse seat backs shall be minimized to increase passenger knee room and bus capacity. The backrest shall not be thicker than 1" at the edges and 1/2" in the center when utilizing "T2C" vandal resistant inserts. A curved backrest shall allow the seat hip-to-knee measurement to be greater than the seat pitch.

Seat backrests shall taper toward the top to accommodate required aisle spacing. The aisle between the seats on a 102" wide bus shall be no less than 20" wide at seated passenger hip height and no less than 24" at standing passenger hip height. The aisle between the seats on a 96" wide bus shall be no less than 16" wide at seated passenger hip height and no less than 20" at standing passenger hip height.

Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14". Seats immediately behind the wheel housings may have foot room reduced, provided the wheelhouse is shaped so that it may be used as a footrest.

**SEAT FRAME:** Each seated position shall have its own seat frame assembly. The seat shall have well defined individual seating positions. All metal of the standard seat structure including the frame, cantilever, pedestals, beams, mounting brackets and other components shall be stainless steel with beaded finish. The frame shall be constructed of 25mm OD tube with 2mm wall thickness.

The passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized to facilitate cleaning. Cantilevered seats shall be mounted to the sidewall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12" of the aisle shall be at least 10" above the floor. Cantilever assemblies must be collapsible with pivoting linkages at the lower wall mounting bracket and the junction between the



cantilever leg and beam assembly. The lowest part of a pedestal-mounted seat that is within 12" of the aisle, excluding the pedestal, shall be at least 10" above the floor.

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 Critical requirements. 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".

The seat shall be supplied with a stainless steel spacer that closes any gaps between the seat frames. The spacer shall run the entire length of the seat cushion and backrest.

**SEAT CUSHIONS / INSERTS:** The seat and backrest cushions shall extend the full width and height of the seat frame with a minimum width of 15.5" of upholstery. The upholstery material shall come into contact with the seat frame to maximize the amount of upholstered surface area that is in contact with the seated passenger. The seat cushion assembly shall have a waterfall front edge.

The cushions shall be padded with a cellular foam product that complies with the physical test requirements and is no less than 1/2" thick in areas contacted and loaded by passengers in the normal seated position. (Alternatively: The cushions shall have no padding; the upholstery is to be bonded directly to the cushion insert – T2C). The inserts shall be covered with vinyl and/or fabric material. Seat covering materials shall be selected on the basis of durability, ease of maintenance, and pleasing texture and appearance.

Additionally, the padded cushions may also be vandal resistant "PT2C" (padded tough-to-cut)

Inserts shall be securely attached by replaceable fasteners. Service time to exchange the inserts shall not exceed three minutes. The inserts shall be either injection molded or fiberglass construction. All inserts should be interchangeable throughout the bus, with the exception of when using a slim flip seat application.

**BACK SHROUD:** The seat back shall be covered with a brushed stainless steel back shroud that covers the entire backrest. The stainless steel construction shall minimize damage from vandalism and shall reduce cleaning time. The structure including the flat thermoform back shroud must meet all the test requirements of the Federal Procurement Guidelines (White Book) as listed below. These include a HIC value of less than 400. All fasteners shall be hidden. The back shroud shall be quickly and easily removed by mechanics, but not by passengers.

**GRAB RAIL:** The back of each transverse seat shall incorporate a handhold no less than 7/8" in diameter for standees and seat access/egress. Individual handholds shall be mounted to each seat frame. The service time to exchange grab handles shall not exceed five minutes. The handhold shall not be a safety hazard during severe decelerations. The handhold of all aisle seats shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4" 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. Handholds on seats not directly on the aisle shall be maximum 3" tall to allow maximum visibility of the seated occupants behind the seat. Each 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. All grab rails shall be curved to match the curvature of an occupants back torso. Longitudinal seats shall be the same general design as transverse seats but without grab rails.

**TEST REQUIREMENTS:** 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 " .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", measured at the aisle side of the seat frame at height H. Seat back should not deflect more than 14", 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" 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" 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" pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10, and 12". 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". Seat cushions shall withstand 100,000 randomly positioned 3-1/2"- 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.

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 6 year old child 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.

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" permanent formation.

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" permanent deformation and without visible deterioration.

**REPORTING REQUIREMENTS:** The Contractor shall be capable of providing a test report fully documenting 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 the Federal Procurement Guidelines (White Book), section 5: Technical Specifications. Testing must be done by an independent, certified testing facility.

**WHEELCHAIR ACCOMMODATIONS:** Two locations, as close to the wheelchair loading systems as practical, shall provide parking space and secure tie-down for a passenger in a wheelchair. Additional equipment, including passenger restraint seat belts and wheelchair

securement devices shall be provided for two wheelchair passengers. Passenger restraint seat belts shall be provided to accommodate passengers in electrically powered wheelchairs. All belt assemblies must stow up and out of the way when not in use.

### TSD 76.5 Hip-to-Knee Room Insert 76.5 from original Drain Holes in Seat

Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to vertical surface immediately in front, shall be a minimum of 26 in. At all seating positions in paired transverse seats immediately behind other seating positions, hip-to-knee room shall be no less than 27 in.

### TSD 76.6 Foot Room

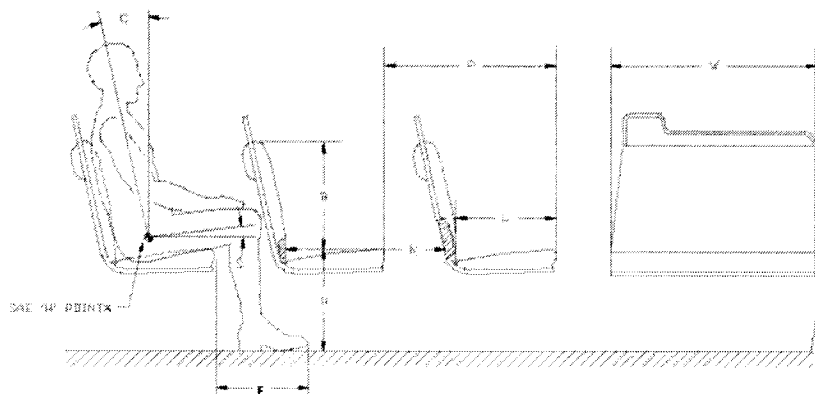
Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 in. Seats immediately behind the wheel housings and modesty panels may have foot room reduced.

## TSD 76.7 Aisles

The aisle between the seats shall be no less than 20 in. wide at seated passenger hip height. Seat backs shall be shaped to increase this dimension to no less than 24 in. at 32 in. above the floor (standing passenger hip height). There shall be an ADA compliant wheelchair accessible route from the Center doors to the securement areas at the front of the bus.

## TSD 76.8 Dimensions

**FIGURE 7**  
Seating Dimensions and Standard Configuration



Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to Figure 7):

- The width, W, of the two-passenger transverse seat shall be a minimum 35 in.
- The length, L, shall be 17 in.,  $\pm 1$  in.
- The seat back height, B, shall be a minimum of 15 in.
- The seat height, H, shall be 17 in.,  $\pm 1$  in. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of under-floor components, a cushion height of up to 18 in.,  $\pm 2$  in., will be allowed. This shall also be allowed for limited transverse seats, but only with the expressed approval of the City.

- Foot room = F.
- The seat cushion slope, S, shall be between 5 and 11 degrees.
- The seat back slope, C, shall be between 8 and 17 degrees.
- Hip to knee room = K.
- The pitch, P, is shown as reference only.

#### **TSD 76.9 Construction and Materials**

Selected materials shall minimize damage from vandalism and shall reduce cleaning time. The seats shall be attached to the frame with tamper-resistant fasteners. Coloring shall be consistent throughout the seat material, with no visually exposed portion painted. Any exposed metal touching the sides or the floor of the bus shall be stainless steel. The seat, pads and cushions shall be contoured for individuality, lateral support and maximum comfort and shall fit the framework to reduce exposed edges.

The minimum radius of any part of the seat back, handhold or modesty panel in the head or chest impact zone shall be a nominal ¼-in. The seat back and seat back handhold immediately forward of transverse seats shall be constructed of energy-absorbing materials to provide passenger protection and, in a severe crash, allow the passenger to deform the seating materials in the impact areas. Complete seat assemblies shall be interchangeable to the extent practicable.

City to select seat fabric.

#### **TSD 76.10 Bicycle Storage Area**

Interior bicycle storage will be on both sides of the bus from just forward of the rear doors to the rear of the turntable and bellows area. There will be no seating in this space. Continuous, full grip, overhead assists shall be provided for riders on the curb-side (see TS 77.5 below). Vertical assists shall be provided immediately forward of the curb-side rear doors and immediately to the rear of the turntable on both sides (see TS 77.4 below). Bicycle racks for three bicycles may be installed on the street-side area. We may provide our own racks. **Please present pricing for:**

- **Cost of the racks and installation for racks you would provide. Racks would be installed on the street-side in front of the rear door and store three (3) bicycles, with no racks or seating on the curb-side.**

#### ***TSD 77. Passenger Assists***

Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and the 5th-percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of seat back assist or as a separate item so that a 5th-percentile female passenger may easily move from one assist to another using one hand and the other without losing support. All handholds and stanchions at front doorway, around farebox, and at interior steps for bi-level designs shall be powder-coated in a high-contrast yellow color. The forward-most vertical stanchions on either side of the aisle immediately behind the driver's area shall be:

Stainless steel finish.



**TSD 77.1 Assists**

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1¼ and 1½ in. or shall provide an equivalent gripping surface with no corner radii less than ¼ in. All passenger assists shall permit a full hand grip with no less than 1½ in. of knuckle clearance around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items and shall be capable of passing the NHTSA Drawstring Test.

Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. Seat handholds may be of the same construction and finish as the seat frame. Door mounted passenger assists shall be of anodized aluminum, stainless steel or powder-coated metal. Connecting tees and angles may be powder-coated metal castings. Assists shall withstand a force of 300 lbs applied over a 12-in. lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads and other fasteners used on the passenger assists shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

**TSD 77.2 Front Doorway**

Front doors, or the entry area, shall be fitted with ADA-compliant assists. Assists shall be as far outward as practicable, but shall be located no farther inboard than 6 in. from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assist and the assists on the wheel housing or on the front modesty panel.

**TSD 77.3 Vestibule**

The aisle side of the driver's barrier, the wheel housings, and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 in. of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The assist shall be no less than 36 in. above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the driver's barrier, wheel housings or front modesty panel.

**TSD 77.4 Rear Doorway(s)**

Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists having a cross-sectional diameter between 1¼ and 1½ in. or providing an equivalent gripping surface with no corner radii less than ¼ in., and shall provide at least 1½ in. of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 in. from the outside edge of the rear doorway step.



### **TSD 77.5 Overhead**

Except forward of the standee line and at the rear door, a continuous, full grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 in. above the floor.

Grab straps or other extensions as necessary shall be provided for sections where vertical assists are not available and for the use by passengers that cannot reach to 70 in.

Grab straps shall be fabric.

Overhead assists shall simultaneously support 150 lbs on any 12-in. length. No more than 5 percent of the full grip feature shall be lost due to assist supports.

### **TSD 77.6 Longitudinal Seat Assists**

Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheelchair securement. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practicable and shall be no more than 52 in. apart or functionally continuous for a 5th percentile female passenger.

### **TSD 77.7 Wheel Housing Barriers/Assists**

Unless passenger seating is provided on top of wheel housing, passenger assists shall be mounted around the exposed sides of the wheel housings (and propulsion compartments if applicable), which shall also be designed to prevent passengers from sitting on wheel housings. Such passenger assists shall also effectively retain items, such as bags and luggage, placed on top of wheel housing.

## ***TSD 78. Passenger Doors***

Doorways will be provided in the locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

### **Operation**

The operation of the curb-side doors and the street-side doors shall be independent. When the Street-side doors are actuated, the curb-side doors shall be locked out and actuation impossible. When the curb-side doors are actuated, the street-side doors shall be locked out and actuation impossible. Operation of, and power to the passenger doors shall be completely controlled by the operator. The passenger doors shall be electric powered.

**TABLE 7**  
Door Operating  
Combinations

Front	Center	Rear
Open	Closed	Closed
Open	Open	Closed
Open	Open	Open
Closed	Open	Open
Closed	Closed	Open
Closed	Closed	Closed

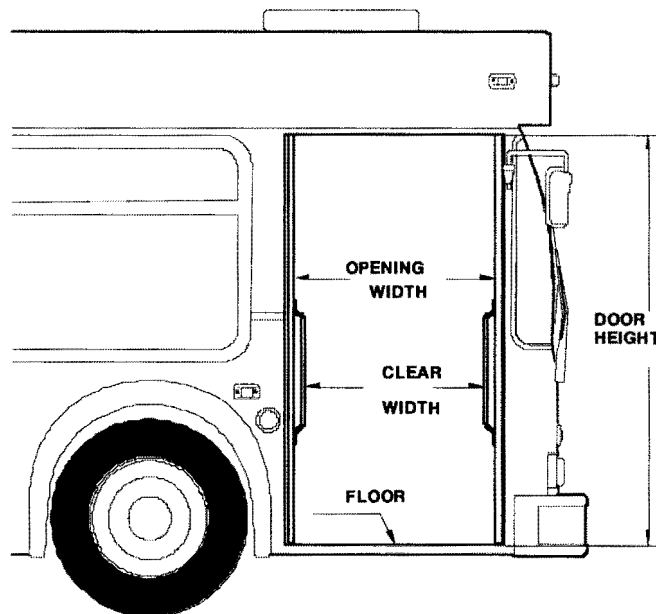
### Materials and Construction

Structure of the doors, their attachments, inside and outside trim panels and any mechanism exposed to the elements shall be corrosion-resistant. Door panel construction shall be of corrosion-resistant metal or reinforced non-metallic composite materials. When fully opened, the doors shall provide a firm support and shall not be damaged if used as an assist by passengers during ingress or egress. Door edges shall be sealed to prevent infiltration of exterior moisture, noise, dirt and air elements from entering the passenger compartment, to the maximum extent possible based on door types.

The closing edge of each door panel shall have no less than 2 in. of soft weather stripping. The doors, when closed, shall be effectively sealed, and the hard surfaces of the doors shall be at least 4 in. apart. The combined weather seal and window glazing elements of the front door shall not exceed 10 degrees of binocular obstruction of the driver's view through the closed door.

### TSD 78.1 Dimensions

**FIGURE 8**  
Transit Bus Minimum Door Opening



When open, the front door shall leave an opening no less than 75.3 in. in height.

The rear door clear width shall be a minimum of 44 in. with the doors fully opened.

### **TSD 78.2 Door Glazing**

The upper section of all doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section.

Door glazing shall be easily replaceable. Zip type glazing rubber.

All doors window glazing material shall be Thermo Guard Blue Spruce 70. The glazing shall have 6 mm laminated heat-treated safety glass. The material shall conform to the requirements of ANSI Z26.1 and the Recommended Practices defined in SAJ673. The tint shall be blue with 70% LT or greater and comply with AS2 DOT requirements, blocking 99% of the UV and allowing less than 3–6% of the infrared heat to pass through the pane.

### **TSD 78.3 Door Projection**

#### **Exterior**

The exterior projection of the front doors beyond the side of the bus shall be minimized and shall not block the line of sight of the rear exit doors via the curb side mirror when the doors are fully open. The exterior projection of both doors shall be minimized and shall not exceed 13 in. during the opening or closing cycles or when doors are fully opened.

#### **Interior**

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

### **TSD 78.4 Door Height Above Pavement**

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

### **TSD 78.5 Closing Force**

Closing door edge speed shall not exceed 12 in. per second, and opening door speed shall not exceed 19 in. per second. Power doors shall not slam closed under any circumstance, even if the door is obstructed during the closing cycle. If a door is obstructed during the closing cycle, the pressure exerted on the obstruction shall not increase once initial contact has been made.

Power-close rear doors shall be equipped with an obstruction sensing system such that if an obstruction is within the path of the closing doors, the doors will stop and/or reverse direction prior to imparting a 10-lb force on 1 sq. in. of that obstruction. If a contactless obstruction sensing system is employed, it shall be capable of discriminating between the normal doorway environment and passengers or other obstructions within the doorway, and of altering the zones of detection based upon the operating state of the door system.

Doors closed by a return spring or counterweight-type device shall be equipped with an obstruction-sensing device that, at a minimum, alerts the driver if an obstruction is detected between the closing doors. Doors closed by a return spring or counterweight type device, when unlocked, shall be capable of being pushed to the point where the door starts to open with a force not to exceed 25 lbs applied to the center edge of the forward door panel.

Whether or not the obstruction sensing system is present or functional, it shall be possible to withdraw a 1½ in. diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 lbs.

#### **TSD 78.6 Actuators**

Doors shall open or close completely in not more than 3.5 seconds from the time of control actuation and shall be subject to the closing force requirements.

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the above requirements. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be re-buildable. If powered by compressed air, exhaust from the door system shall be routed below the floor of the bus to prevent accumulation of any oil that may be present in the air system and to muffle sound.

Door actuators and associated linkages shall maximize door holding forces in the fully open and fully closed positions to provide firm, non-rattling, non-fluttering door panels while minimizing the force exerted by the doors on an obstruction midway between the fully open and closed positions.

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

A switch located within reach of the seated operator shall, when actuated, restore rear door function to complete operator control, as described in the "Default."

Doors that employ a "swing" or pantograph geometry and/or are closed by a return spring or counterweight-type device shall be equipped with a positive mechanical holding device that automatically engages and prevents the actuation mechanism from being back-driven from the fully closed position. The holding device shall be overcome only when the driver's door control is moved to an "Exit Door Enable" position and the vehicle is moving at a speed of less than 2 mph, or in the event of actuation of the emergency door release.

Locked doors shall require a force of more than 300 lbs. to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, actuators or complex mechanism.

#### **TSD 78.7 Rear Door Interlocks**

See "Hardware Mounting" for door system interlock requirements.

#### **TSD 78.8 Emergency Operation**

In the event of an emergency, it shall be possible to manually open doors designated as emergency exits from inside the bus using a force of no more than 25 lbs. after actuating an unlocking device. The unlocking device shall be clearly marked as an emergency-only device and shall require two distinct actions to actuate. The respective door emergency unlocking device shall be accessible from the doorway area. The unlocking device shall be easily reset by the operator without special tools or opening the door mechanism enclosure. Doors that are required to be classified as "Emergency Exits" shall meet the requirements of FMVSS 217.

### **TSD 78.9 Door Control**

The door control shall be located in the operator's area within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach." The driver's door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation.

Door control located on street side. The front door shall remain in commanded state position even if power is removed or lost.

### **TSD 78.10 Door Controller**

#### **Push-Button Door Controls**

Doors shall be operated by push-button controls, conveniently located and operable within the driver's reach. The push buttons shall be labeled. There shall be a separate set of push button controls for the curb-side and street-side doors as needed.

### **TSD 78.11 Door Open/Close**

#### **Operator-Controlled Front and Passenger-Controlled Rear Doors with Provision for Driver Override**

Operation of, and power to, the front passenger doors shall be completely controlled by the operator. Power to rear doors shall be controlled by operator. After enabling, the rear doors shall be opened by the passenger. A switch shall be provided to enable the driver to obtain full control of the rear doors.

A control or valve in the operator's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear/center doors, deactivate the door control system, release the interlocks, and permit only manual operation of the rear/center doors.

### ***TSD 79. Accessibility Provisions***

Space and body structural provisions shall be provided at all curb-side and street-side doors of the bus to accommodate wheelchair loading systems.

#### **TSD 79.1 Loading Systems**

- low-floor ramp - front curb-side door
- fold out bridging plate or docking ramp – all other doors

#### **TSD 79.2 Loading System for 30- to 60-ft Low-Floor Bus**

An automatically-controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level platform, street or curb.

#### **Front Door Location of Loading System, Flip-Out Design Ramp with 6:1 Slope**

The wheelchair loading system shall be located at the curb-side front door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 6:1 slope.



### **TSD 79.3 Loading System for Level Boarding on a 60-ft Low-Floor BRT**

Fold out bridge plates/docking ramps shall be installed on both the street-side doors and middle and rear curb-side doors to insure that passengers with mobility devices can easily cross up to a 12-inch gap between the station platforms and the bus.

### **TSD 79.4 Wheelchair Accommodations**

One Qstraint Q'Pod System and One Qstraint Quantum System shall be provided for a total of two positions to secure mobility devices. As a backup tie down system for the Quantum, a model Q-8300-A1-SC should be installed with the Quantum to be used to secure wheelchairs should the Quantum unit fail. These restraint systems will be located in the front of the bus near the operator's position.

### **One Forward-Facing, and One Rear-Facing Wheelchair Securement Location**

One forward-facing location, and one rear-facing location, as close to the wheelchair loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheelchair.

### **TSD 79.5 Interior Circulation**

Maneuvering room inside the bus shall accommodate easy travel for a passenger in a wheelchair from the loading device and from the designated securement area. It shall be designed so that no portion of the wheelchair protrudes into the aisle of the bus when parked in the designated parking space(s). When the positions are fully utilized, an aisle space of no less than 20 in. shall be maintained. As a guide, no width dimension should be less than 34 in. Areas requiring 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 in., and in the parking area where 180-degree turns are expected, space should be clear in a full 60-in.-diameter circle. A vertical clearance of 12 in. above the floor surface should be provided on the outside of turning areas for wheelchair footrest.

## **SIGNAGE AND COMMUNICATION**

### ***TSD 80. Destination Signs***

A Hanover destination sign system shall be furnished on the front, one on the curb-side behind the front door; one the street-side behind the front door and route sign on the rear of the vehicle.

### **Current Specs:**

Front: 66" x 11"

Curb-Side: 50-5/8" x 8.25" (LED Matrix)

Street-Side: 50-5/8" x 8.25" (LED Matrix)

Rear: 21" x 9"

Controller: (E420F)

### **Street Side, Curb Side and Route Signs**

The street-side and curb-side signs will each be at the large window immediately forward of the center bus doors. Display areas of destination signs shall be clearly visible in direct sunlight and/or at night. Parts shall be commercially available.

All signs shall be controlled via a single human-machine interface (HMI), which will serve as the secondary control unit for the signs. The buses will be equipped with a single mobile data terminal

(MDT), sometimes referred to as an Operator Control Unit (OCU), which interfaces with the sign controller. For that reason, the HMI is used only in unusual circumstances. It can be mounted in the bulkhead storage compartment or other location, accessible by the driver, but it does not have to be within reach of a seated driver.

The destination sign compartments shall meet the following minimum requirements:

- Compartments shall be designed to prevent condensation and entry of moisture and dirt.
- Compartments shall be designed to prevent fogging of both compartment window and glazing on unit itself.
- Access shall be provided to allow cleaning of inside compartment window and unit glazing.
- Front window shall have an exterior display area of no less than 8.5 in. high by 56 in. wide.

## ***TSD 81. Passenger Information***

### **TS 81.1 Train Bell Sound**

Equip the bus with an electronic bell or gong sound similar to the bell a train uses when stopping at a station. The operator has a control switch to warn passengers inside and outside that the bus is approaching the station platform. This feature must not override ADA announcements and be independent of the horn.

## ***TSD 82. Interior Displays***

### **TS 82.1 Vandalism Discouragement Display**

An LCD screen mounted on the rear facing portion of the electronics cabinet shall be installed. The LCD screen must be a minimum of 17" and must have component (RCA) video input. A coax cable shall be connected from the back of DVR2's BNC connection to this screen.

Please provide a price for the following option:

### **TSD 82.2 Optional Infotainment System**

The bus shall come equipped with an Infotainment system including the management system on the backend and the public display LCD screens on the vehicles. To effectively communicate with all passengers aboard the bus, each bus will be required to have at least 2 LCD screens devoted to this purpose. Audio is not required for the Infotainment system.

The system shall be capable of the following:

1. Provide travel information to the passengers. The information to be provided should include:
  - Ad hoc messages about travel delays or detours
  - Real time travel and location information – show the estimated time of arrival of the bus at upcoming stations or show a map of the current location of the bus and the next 2 or 3 stations on the route;
2. ABQ RIDE agency information, including upcoming events or service provided during upcoming holidays
3. Provide advertising to passengers, either on a continuous loop or geospatially triggered.

The content shall be accessible for update over cellular communications (each bus is already equipped with a 4G modem with a fixed IP address) or through Wi-Fi (each bus is already equipped with a router capable of accessing the closed, Transit controlled WAN, both in the

maintenance yard and at each bus station along the ART route).

**Please present options and pricing for each:**

- **System with Ad hoc messages and real-time travel and location information on a map and at least two (2) LCD screens 15 inches or larger.**
- **System displaying agency information about upcoming events and service changes updated wirelessly to be displayed by two (2) LCD screens 15 inches or larger.**
- **System displaying advertising to passengers in addition to Ad hoc messages, real-time travel and location information on a map and at least two (2) LCD screens 15 inches or larger.**
- **Pricing to include both initial capital purchase price as well as any annual cost for subscriptions or software maintenance**

### ***TSD 83. Passenger Stop Request/Exit Signal***

#### **Pull Cord Passenger Signal**

A passenger "stop requested" signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37 shall be provided. The system shall consist of a heavy-duty pull cable, chime and interior sign message. The pull cable shall be located the full length of the bus on the sidewalls at the level where the transom is located. If no transom window is required, the height of the pull cable shall approximate this transom level and shall be no greater than 63 in. as measured from the floor surface. It shall be easily accessible to all passengers, seated or standing. Pull cable(s) shall activate one or more solid state or magnetic proximity switches. At each wheelchair passenger position and at priority seating positions, additional provisions shall be included to allow a passenger in a mobility aid to easily activate the "stop requested" signal.

Auxiliary passenger "stop requested" signals shall be installed at the center and rear doors on both sides to provide passengers standing in the rear door/exit area convenient means of activating the signal system. The signal shall be a heavy-duty push button type located in the rear door vicinity. Button shall be clearly identified as "passenger signal."

No requirements for additional "stop request" button on rear door stanchion.

A single "stop requested" chime shall sound when the system is first activated. A double chime shall sound anytime the system is activated from wheelchair passenger areas.

Exit signals located in the wheelchair passenger area shall be no higher than 4 feet above the floor. Instructions shall be provided to clearly indicate function and operation of these signals.

City to specify the stop request system for wheelchair seating area.

### ***TSD 84. Communications***

#### **TSD 84.1 Camera Surveillance System**

Provide all wiring and mounting locations for a multi-camera surveillance system including the installation of cameras, recorder, microphone, etc.

#### **Camera System Specifications:**

Two Seon DX-HD digital video recorders (DVRs), associated equipment and accessories or approved equal shall be installed on each bus. One of the DVRs (DVR1) shall be connected to

all exterior viewing cameras. The second of the two DVRs (DVR2) shall be connected to all interior viewing cameras (see camera placement diagram).

The two DVRs shall have an integrated and internally built in inertia sensors. The inertia sensors shall record movements in forward, backward, left, right, vertical up and vertical down directions.

Each DVR shall have two removable hard disk drives that are mounted in one cassette. Each of the two hard disk drives shall be a minimum of 1TB in size, providing a total of 2TB of recording space. If one of the two hard disk drives fails, the other will continue to function with its own recording space of 1TB.

Each DVRs shall have the ability to accept video feeds from a minimum of 12 total channels with audio and 1 high-definition channel. The DVR shall have the ability to record 30 frames per second on all 13 channels.

Each DVR shall have the ability to accept GPS signals to calculate the vehicle's latitude and longitude. Each DVR shall also have the ability to automatically adjust its internal clock from GPS signals.

Each DVR shall have the ability to digitally save and load its entire configuration from a USB storage device.

Each DVR shall have the ability to record and replay in dual stream. Each stream of video shall be configurable. The lower quality stream shall be used for fast viewing over data cellular connectivity or slower data connection methods. The higher quality stream shall be used for clarity of images and higher data connection methods.

Each DVR shall have the ability to record 12 independent audio tracks.

Each DVR shall have a minimum of three Ethernet RJ45 ports and two USB ports. Offloading of video and audio can be performed by connecting a USB data storage device to the DVR.

All cameras shall have automatic and integrated infrared emitters for low-light or zero-light conditions.

All interior dome cameras shall have integrated audio recording capabilities.

<b><u>Part ID or Approved Equal</u></b>	<b><u>Description</u></b>	<b><u>Qty Per Bus</u></b>
DXHDNH2T0	DXHD DVR with 20' Power harness, 2x1TB HDD, NO BP	2
WPO0AG4	Smart-Link Bundle W/DIA/SIG/H4/GPS4	2
CA904EI20	CA904EI Camera with 20ft Cable Harness	3
CA904EI50	CA904EI Camera with 50ft Cable Harness	3
CA904EI75	CA904EI Camera with 75ft Cable Harness	1
CQ903A20	CQ903A Camera with 20ft Cable Harness	3
CQ903A50	CQ903A Camera with 50ft Cable Harness	3
CQ903A75	CQ903A Camera with 50ft Cable Harness	3

CHW702EJ20  
CA-MP6  
DXHD-HK2T0

CHW702E Camera with 20ft Cable Harness & PPOE  
Assembly, CHW/CA Camera 6" Mounting Post  
Assembly, Service Package, DXHD 2x1TB HDD

1  
1  
2

### Vehicle Data Recorded as Signal Inputs

Signal inputs shall be connected to DVR2

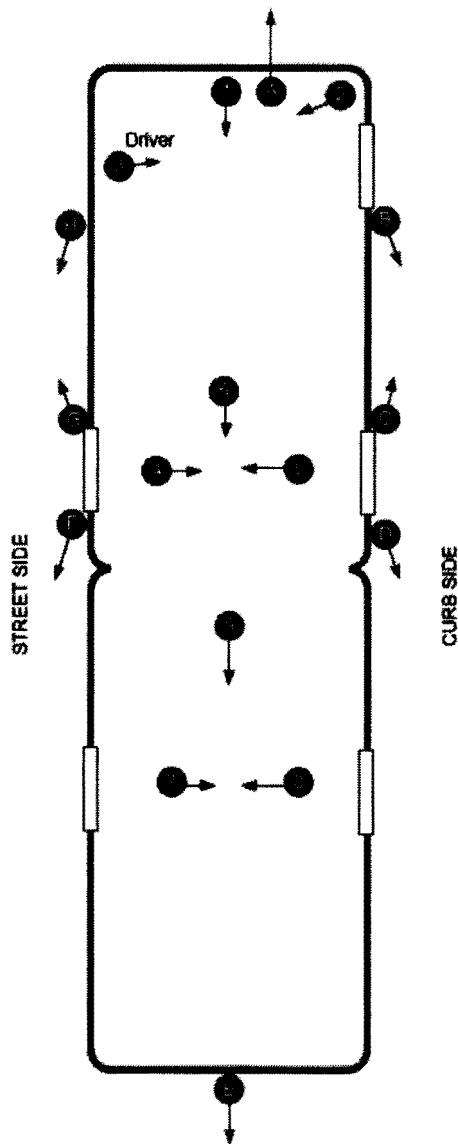
Left turn signal

Right turn signal

Brakes applied

Bus stop requested / wheelchair lift requested

### Camera Location Diagram and DVR Use



DVR1	DVR2
A Traffic in front and traffic control signals	1 Center of bus isle view CQ903A20
B Loading/exit area at center door	2 Driver with as much view of the driver's face and hands as possible CQ903A20
C Loading/exit area at front door	3 Front entry door and activity near fare box CQ903A20
D Loading/exit area at rear door	4 Center curb side door CQ903A50
E Approaching traffic coming toward rear of bus	5 Center street side door CQ903A50
F Loading/exit area at rear door	6 Center isle of bus and surrounding seats CQ903A50
G Traffic near front right corner of bus	7 Rear curb side door CQ903A75
H Loading/exit area at center door	8 Rear street side door CQ903A75
	9 Rear seating area CQ903A75



**TSD 84.2.1 Public Address System****ADA Announcement System**

A Digital Recorders DR700 Talking Bus® stop announcement system or approved equal shall be installed on each vehicle. The system shall meet or exceed all ADA requirements found in 49CFR Parts 37.167 and 38.35 and shall provide different, simultaneous audio announcements to riders on-board and waiting curbside. The system shall also provide a control capability for integrating present and future electronics on the bus. In order to maximize the system's useful life and to ensure ease of integration with third party electronics on transit vehicles, the system shall provide a robust, open software and hardware architecture. The system shall comply with SAE J1587/J1939 vehicle communications protocols. The system shall have the capability of hardware and software extension to include new or additional features. The system shall also incorporate ease of programming and updates of all operating information.

**Automatic Voice Annunciator System (AVAS)**

The DR700, or approved equal, stop announcement system shall be capable of providing a single log-on for other in-vehicle electronics systems (e.g.; destination / head signs systems, fare collection systems, automatic passenger counters, etc.). The communications protocol to accomplish system integration shall be SAE J1587/J1939 or DRSIP. The system shall include an easy-to-use means of specifying whether log-on and/or passwords are required, and what vehicle operator ID's and passwords are acceptable for each sub-system.

The system shall allow the operator to select the route and shall display the route and the next stop to be announced on the operator control unit. The operator shall have the ability to scroll forward or backward within the selected route's list of announcements. Internal announcements are intended for on-board riders and shall play either by manual activation by the operator or in response to signals received by an on-board Automatic Message Trigger (AMT). The Automatic Message Trigger function shall incorporate a Global Positioning System (GPS) receiver with WAAS and dead-reckoning augmentations. External announcements shall play automatically when the door is opened for a stop.

The system shall also provide the ability to define and play up to 99 special announcements and 200 announcements which play at pre-defined times of day, depending upon the amount of memory available. The system shall provide the ability to play external announcements on a repeating "loop" at regular time intervals until canceled by the operator.

The system shall provide an easy-to-use means of updating the programmed database in the in-vehicle stop announcement system's vehicle logic unit with a USB data key and by connection to a local area network though a wireless network connection.

The DR700, or approved equal, stop announcement system shall have dual channel audio capable of playing simultaneous internal and external announcements. Vendor shall provide all database programming and route mapping services necessary for the system to be fully functional.

The system shall include a noise-sensing function. An Automatic Volume Control (AVC) system with three sensing inputs shall automatically and independently adjust each channel's audio volume as appropriate in response to ambient noise detected.

### **Operator Control Unit**

The LT2 Operator Control Unit (OCU), in conjunction with the VLU, shall provide a single operator log-on for electronic devices on the transit vehicles, at the Authority's discretion. The OCU shall provide a display and keypad which are specifically adapted for transit operations. The LT2 OCU shall have the functionality to update both the destination signs and the voice annunciation system. Any programming changes for either the destination signs and/or the voice annunciation system can be written to a single USB Key and that one key used to update both systems through the Vehicle Logic Unit. The OCU shall be easily located within the vehicle operator area; operate under a wide temperature range (-20°C to +70°C) and have dedicated keys for functions such as:

- Safety/Regulatory Announcements
- Route A/Route B selection
- Repeat Last Announcement
- Loop External Announcement
- Increase/decrease display screen's brightness
- Arrow keys for scrolling forward or backward
- Activate Internal Announcements
- P/R Button
- Mic. Volume button
- Menu button

The OCU Unit shall contain a display of at least two-lines of 20-character capability. The OCU Unit shall contain an audio speaker that beeps indicating that a key is depressed.

The OCU enclosure shall be constructed of rugged aluminum housing and meet FCC Part 15 for shielding of EMI/RFI. The OCU keypad shall have a minimum of 28 keys within a sealed, elastomeric membrane. An audible beep shall sound when keys are activated. A warning beep shall sound to indicate incorrect key selection.

### **Type-N Operator Control Unit**

The Type-N Operator Control Unit (OCU), in conjunction with the VLU, shall provide a single operator log-on for electronic devices on the transit vehicles, at the authority's discretion.

The MDT shall provide a display and keypad which are specifically adapted for transit operations. The Type-N shall have the functionality to control both the destination signs and the voice annunciation system.

The graphical display of the MDT shall allow for a variety of fonts with multiple lines of text and up to 40 characters per line. The MDT shall also contain an audio annunciator that beeps indicating that a key is depressed. A warning beep sounds to indicate incorrect key selection. The MDT keypad shall have 18 keys within a sealed, electrometric membrane and a rotary dial with a push to select function. The MDT enclosure shall be constructed using a rugged housing and meet FCC Part 15 for shielding of EMI/RFI.

It shall be possible to configure the MDT to work as an AVAS MDT only device, or to interwork with the DR AVL2 system.

### **Vehicle Logic Unit**

The DR700 VLU, or approved equal, shall provide the hardware and software necessary to:

- Provide a single-point operator login for connected equipment
- Coordinate audio announcements and sign displays
- Accept data generated by the Route Mapping Module (RMM) and Central Recording Station (CRS) database software applications or their equivalents
- Off-load data and accept updates via USB data Key and/or 802.11x WLAN
- Integrate with Digital Recorders' Type LT2, Type N, and Type Q Operator Control Units, or their equivalents
- Integrate with internal LED signs for internal announcements
- Interface with J1587/J1939 engine controllers, transmissions, and other onboard devices
- Allow for future hardware and software expansion
- Support Wireless Data Transfer for software, configuration, announcement data, and route data updates
- Supports all features and functions associated with the Digital Recorders AVL2 automatic vehicle location system, or its equivalent

At a minimum, the VLU shall have the following hardware and characteristics:

- Overall size 8.50" long, 8.38" wide, and 3.87" high
- 4 audio outputs, 25W each (2 internal, 1 external, 1 driver monitor speaker)
- 2 Ambient Sensing Inputs
- 16 discrete inputs
- 3 discrete outputs
- 2 x SAE J1708
- 2 x SAE J1939 (CAN 250K)
- 5 x RS232
- 2 x RS485
- 4 x USB
- Integrated 20-channel GPS with dead-reckoning
- 4 x RJ45 Ethernet
- Integrated Wi-Fi capability supporting IEEE 802.11a, b, g, n
- Positive-locking, heavy-duty connectors
- Hardware & software feature expansion
- Built-in real-time clock
- Compliance with DRSIP communications protocol

### **Internal Display Sign**

The internal display sign shall display coordinating text for next stop and other audio announcements. The sign shall meet all ADA requirements for internal signage. The sign shall be a Light Emitting Diode (LED) type sign with 16 characters per line with bright amber LEDs. Sign shall be no larger than 27" x 2 1/8" x 4 1/8" (single line) or 6 1/8" (double line). The sign shall be programmable via the DR700 CRS or its equivalent. Messages can be shown streaming or by any of 3 single frame modes with automatic centering. Speed, delays, and looping shall be programmable. Busy/ready status shall be poll-able. Forced reset capability shall exist.

The internal LED display sign shall be used to display the words "Stop Requested" and shall be visible to passengers when the passenger chime is activated and shall remain on until the front or rear door is opened. The internal LED display sign shall also be used to display "Lift Requested"

when the passenger chime is activated provided there are separate outputs on the vehicle to designate different chimes for Stop Requested and Lift Requested.

Enclosure shall be aluminum with welded and sanded seams, black powder paint finish and acrylic fascia with matte finish for reduction of reflected glare. The sign shall be constructed to withstand the harsh environmental conditions found in transit applications. One shall be installed at the front of the bus, with the second at the front of the rear section of the bus.

### **Audio Diagnostics**

The Stop Announcement vehicle logic unit shall be capable of playing audio diagnostics for all currently integrated electronics and capability for electronics which may be integrated in the future. This includes diagnostics for the destination sign system, internal passenger information signs, Operator Control Unit, internal speaker system, external speaker system, navigation system, and vehicle maintenance devices. The VLU shall confirm proper communications with each of these devices, log results, and provide audio messages describing any failures.

### **Wireless Data Transfer**

The vehicles shall be equipped with Digital Recorders a DR700 with integrated Wi-Fi capability or equivalent. The Wireless Data Transfer System shall include vehicle hardware, base station hardware, and software for wireless transfer of data between a centralized base station and individual fleet vehicles. With the exception of the antenna, the on-vehicle hardware shall be internal to the DR700 or its equivalent. Data shall be transmitted using an industry-standard 802.11 a/b/g/n system with security enhancements-

Data network shall include WPA and WPA2 encryption and authentication. The wireless technology shall not require the transit authority to obtain a transmission license. The system shall communicate in both point-to-point and point-to-multipoint configurations.

The Wireless Data Transfer system shall be bi-directional and shall be used for the purposes of remote data collection from vehicle systems such as APC and AVM and/or for on-vehicle software and data updates.

The system shall permit date-specific deployment of changes and incremental updates (e.g., the system shall transmit only the voice announcements, destination sign text, route and schedule changes, etc. that have changed.) The wireless server software shall be configurable to determine frequency of data transmission and types of data transferred. The software shall make it possible to specify a future time and date for an update to become active.

The system shall allow automatic data transfer initiation (when the vehicle is in range of the base station) and requires no operator interaction.

Data collected from the vehicles shall be clearly labeled at the base station, and the software shall permit sorting/filtering/searching of parameters. Pre-configured, standard reporting options shall be available within the software package itself, and the data may be exported in industry standard delimited formats for external use and specific software applications.

#### **TS 84.2.1.1 Speakers**

The DR-VLU stop announcement system or its equivalent shall utilize 4-6 4 ohm speakers for internal announcements. Internal speakers shall have a range of 70 - 15,000



Hz at a minimum. The external speaker(s) shall be a weatherproof; horn-type constructed of a hard plastic or aluminum material and have a minimum range of 200 - 15,000 Hz.

All internal and external speaker locations shall require prior approval by the Authority.

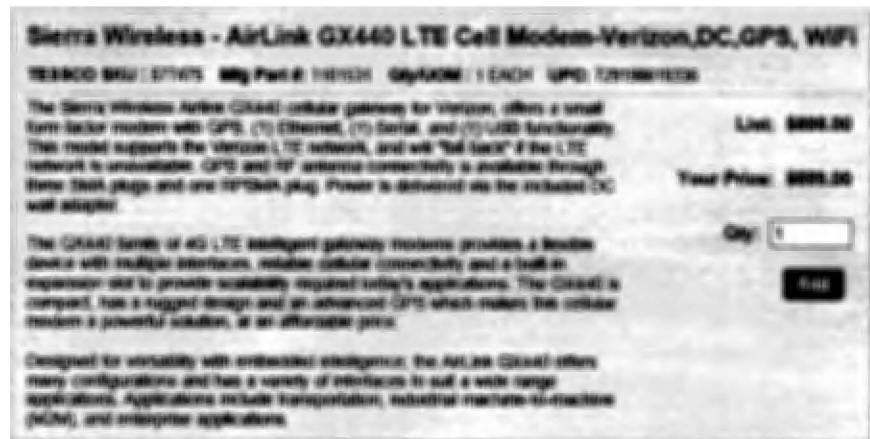
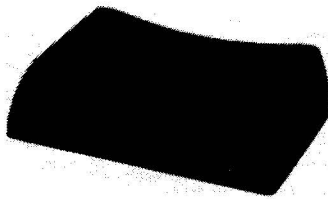
### TSD 84.3 Wireless Mobile Router/Cellular Modem

One Sierra Wireless GX440 or approved equal shall be installed on each bus. The GX440 shall include the WiFi option and additional Ethernet ports option. The GX440 does not require the I/O option.

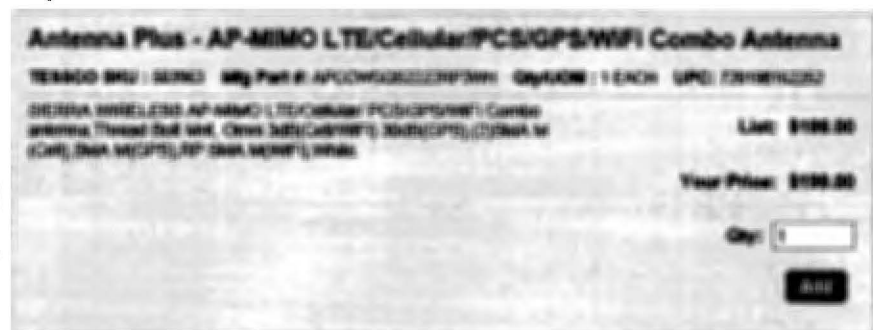
Each bus shall have a Sierra Wireless or approved equal antenna mounted on the roof with appropriate cellular, WiFi and GPS wiring to each GX440. This antenna shall have 8" square aluminum grounding plane. Antenna and grounding plane shall be sealed to prevent water leaks.

The GX440 shall be mounted inside of the electronics cabinet of the bus. The mounting shall provide easy access to cable connections and well as visibility of status lights of the GX440.

Network Systems > Broadband Radios > Cellular Gateways/ Routers/Automation > Cellular Modems > SKU# 577475



Mobile Devices & Accessories > Mobile Antennas & Amplifiers > Mobile Antennas > Dual/Multi Band Antennas > SKU# 503963



### TSD 84.4 Electronics Cabinet Constant Power, Ignition Power and Chassis Ground

The electronics cabinet (EC) shall be located directly behind the driver and on top of the street side front wheel well. The EC shall be water resistant design to prevent water damage from routine bus cleaning. The EC shall have a single wide opening door for ease of access to the interior. The EC's door shall have two square keyed latches. The EC's door shall be a left handed door (hinged at the rear of the cabinet).

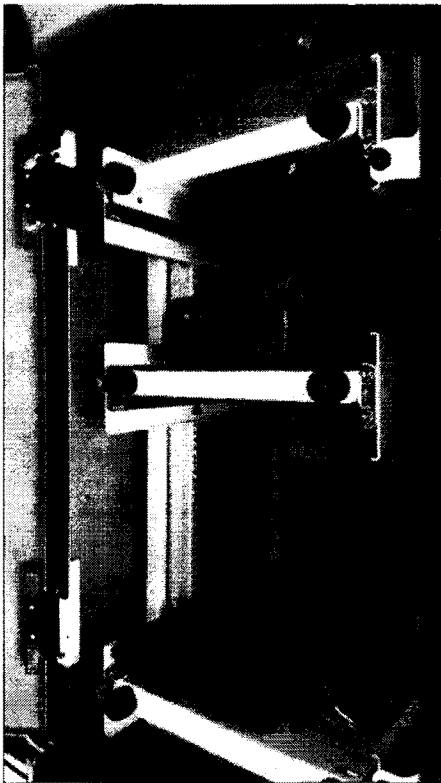


The interior of the EC shall have three trays that is able to slide out. These slides shall be of roller bearing construction and shall also have latches to hold them in the closed or stowed position. Each tray shall have two rubber stoppers facing the EC's door. The surface area of each sliding tray shall be 15" wide by 20" deep. All trays shall have rounded edges to prevent wires from chafing. The mounting enclosure for these trays shall have multiple mounting holes so that trays may be repositioned higher or lower. The first tray shall be mounted near the top of the enclosure. The second tray shall be mounted mid-point. The last tray shall be mounted near the bottom of the enclosure.

The street side of the EC shall be accessible from the outside of the vehicle.



Location of the electronics cabinet



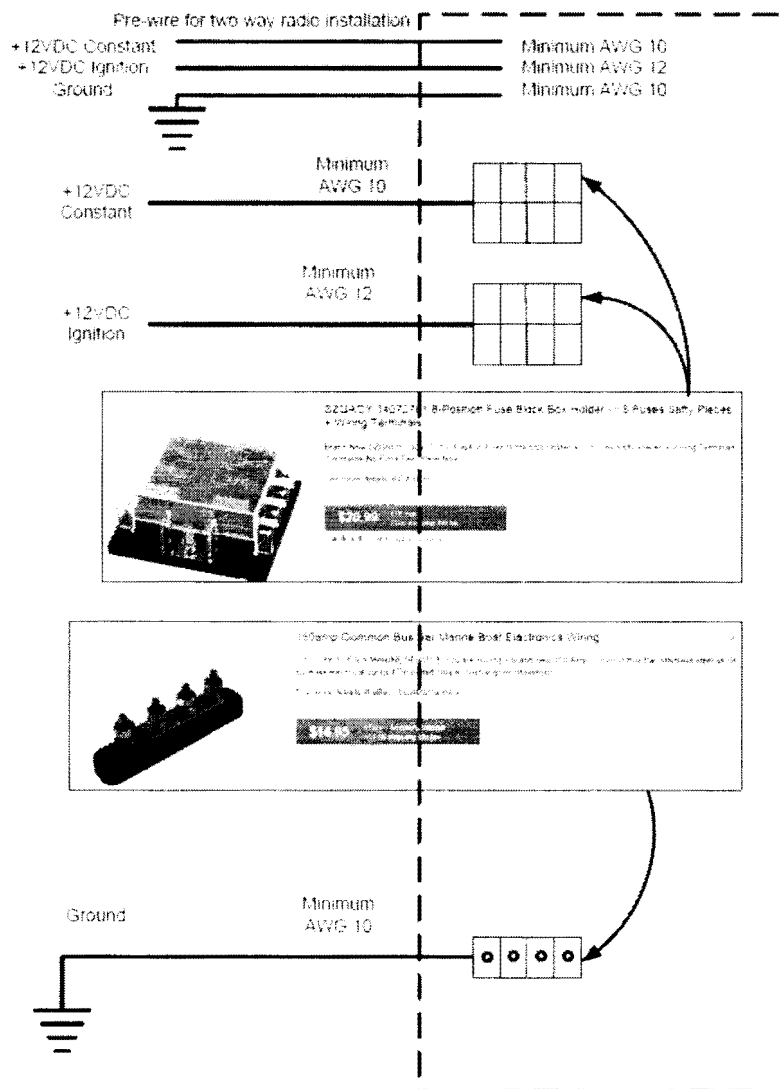
Interior view of electronics cabinet

Wiring for the two way radio: the wiring shall be installed by the successful Offeror, the equipment will be installed by the City of Albuquerque.

- One 10 gauge +12VDC constant
- One 12 gauge +12VDC ignition
- One 10 gauge ground
- A six (six) foot coil of each wire should be left at each termination point

Wiring for IT equipment:

- One 10 gauge +12VDC constant connected to fuse block
- One 12 gauge +12VDC ignition connected to fuse block
- One 10 gauge ground connected to bus bar



### TSD 84.5 Automatic Passenger Counter (APC)

The APC system selected shall have an accuracy rating (comparing the accuracy of the APC to manual counts) of at least 95%, and have been approved by the FTA for NTD reporting in at least

one other jurisdiction.

Each bus shall come equipped with sensors at each door, capable of determining the direction of travel of the passenger (onto the bus or off of the bus). The system shall include whatever data consolidation equipment is required to consolidate the data prior to its transmission to a back end system which will make the data available for reporting. Each APC system will be capable of uploading its data wirelessly to that back end system analyzer or reporting system.

The on-board APC system shall integrate with the electronics and data communications system of the bus so as to use the existing wiring systems of the bus to sense trigger conditions, such as the door open status.

It is preferred that the APC system integrate with whatever GPS and cellular communications devices that are accommodated by equipment required elsewhere in these specifications, specifically the Sierra Wireless GX440.

The vendor supplying the APC system shall provide a warranty covering the equipment installed.

The vendor supplying the APC system shall provide the software required to analyze and report on the data of the on-board equipment, provided that software can be installed on a virtual server. In the event the software cannot be housed on a virtual server, the vendor will also supply any required hardware to serve as the server for this purpose.

The vendor supplying the APC system shall provide a support and maintenance agreement covering items such as firmware updates, phone call and e-mail support, and software upgrades for the software required to configure and manage that reporting and analyzing system. The support agreement will provide for a service level agreement requiring response (can be local or remote) within 48 hours of the notice of outage (e-mail or phone call)

The vendor supplying the APC shall provide onsite training for up to 10 ABQ Ride staff and include topics regarding the installation and configuration of the hardware and software required to configure and manage the APC system.

APCs will need to be installed on all doors.

**Please present options and the pricing:**

#### **TSD 84.6 Radio Handset and Control System**

Each bus shall have the following and shall be supplied to the City of Albuquerque. The City of Albuquerque will be responsible for the installation of the equipment; the Contractor shall install the wiring. Recommended vendor is Daily-Wells Communications, Inc. Contact person is Richard Kirian at 505-453-2029. Delivery address is 1801 4<sup>th</sup> Street NW, Albuquerque, NM 87102 Attn: Renae Jarvies ART Buses.

Qty	Part Number	Description
1	MAHK-S8MEX	Harris M5300 Radio 800 Mhz Trunked/EDACS
1	HK-PL4U	Feature, Single-Key DES Encryption
1	MAHK-NPL7Z	Feature, 512 Systems/Groups

1	MAHK-NCP9E	Control Unit, CH721 Remote Mount
1	MAHK-NZN7R	Accessories, M5300 Remote Mount
1	MAHK-NMC7Z	Microphone, Standard, CH721 Control Unit
1	MACDOS0012	Head Mounting Pedestal

Each bus shall have the following and shall be supplied to the City of Albuquerque. The City of Albuquerque will be responsible for the installation. Recommended vendor is Telephone Components. Same shipping address as above.

Qty	Part Number	Description
1	TG-419X1012	Transit Telephone Style Handset

The entire bus order shall have the following supplied to the City of Albuquerque. Recommended vendor is Tessco. Contact person is Joshua Hamlet at 800-472-8063. Same shipping address as above.

Qty	SKU#	Part Number	Description
2	74227	RFT-1202-2	25 Pk TNC Male Crimp-RG58-141
2	26367	RFN-1005-3C	25 Pk N Male Crimp-RG58-RG141
30	35012	ASP931	806-894 Low Silhouette
3	469004	469004	10 Pk Mini-ATM Fuse Plug
1	36028	RF195-1000	RG58 1000ft Coaxial Cable
3	380840	FH1012-GM/10Pack	ATC Premium Fuse Holder

The entire bus order shall have the following supplied to the City of Albuquerque. Recommended vendor is DigiKey. Same shipping address as above.

Qty	Part Number	Description
30	A32505-ND	DB25 Solder Type Male Connector
60	A33667-ND	DB25 Hood
30	A32508-ND	DB25 Solder Type Female Connector
30	A1410-ND	TE Connectivity 1-480319-0 Receptacle 2pin Mate-n-Lok
30	A1411-ND	TE Connectivity 1-480318-0 Plug 2pin Mate-n-Lok
60	A97888TR-ND	TE Connectivity 61114-1 Conn Socket Mate-n-Lok
60	A97887TR-ND	TE Connectivity 61118-1 Pin Mate-n-Lok
120	952-2314-ND	Standoff DB25 to DB25 Connector

#### **TSD 84.7 On-board Traffic Signal Prioritization (TSP)**

The on-board TSP system shall have the capability to automatically initiate requests for priority at signalized intersection based on the following factors:

- User-specified distance from the signalized intersection.
- Optionally, user-specified number of seconds from the signalized intersection based on vehicle speed and projected arrival time at signalized intersection.

- Conditional priority for signalized intersections where vehicles running behind schedule, based on user-specified threshold for the number of minutes late at the last schedule time point passed by the transit vehicle.
- Ideally, that conditional priority will be based on existing sources of schedule data and GPS coordinates of the bus
- Deactivation of the emitter when the system senses that the door of the bus is open.

The on-board TSP system shall integrate with the electronics and data communications system of the bus so as to use the existing wiring systems of the bus to sense trigger conditions, such as the door open status.

It is preferred that the TSP system integrate with whatever GPS and cellular communications devices that are accommodated by equipment required elsewhere in these specifications, specifically the Sierra Wireless GX440.

The vendor supplying the TSP system shall provide a warranty covering the equipment installed.

The vendor supplying the TSP system shall provide the software required to manage the on-board equipment and the on-street signal light equipment, provided that software can be installed on a virtual server. In the event the software cannot be housed on a virtual server, the vendor will also supply any required hardware to serve as the server for this purpose.

The vendor supplying the TSP system shall provide a support and maintenance agreement covering items such as firmware updates, phone call and e-mail support, and software upgrades for the software required to configure and manage the on-board and on-street equipment. The support agreement will provide for a service level agreement requiring response (can be local or remote) within 48 hours of the notice of outage (e-mail or phone call)

The vendor supplying the TSP shall provide onsite training for up to 10 ABQ Ride staff and include topics regarding the installation and configuration of the software required to configure and manage the TSP system.

**Please provide options and pricing for systems meeting the above requirements.**

#### **TSD 84.8 VIBs**

Install and connect VIBs compatible for communication with Asset Works Fuel Focus.



## SECTION 3.4: TECHNICAL SPECIFICATIONS: ELECTRIC ZERO EMISSIONS BUS GENERAL

### *TSE 1. Scope*

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

### *TSE 2. Definitions*

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

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

**Analog Signals.** A 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).** Monitors energy, as well as temperature, cell or module voltages, and total pack voltage. The BMS adjusts the control strategy algorithms to maintain the batteries at uniform state of charge and optimal temperatures.

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

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

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

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

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

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

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

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

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

**Code.** A legal requirement.

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

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

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

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

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

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

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

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

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

**DC to DC Converter.** A module which converts a source of direct current (DC) from one voltage level to another.

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

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

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

**Destroyed.** Physically made permanently unusable.

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

**DPF.** Diesel particulate filter.

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

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

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

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

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

**Energy Storage System (ESS).** A component or system of components that stores energy and for which its supply of energy is rechargeable by a PPU and/or an off-vehicle energy source.

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

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

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

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

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

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

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

**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.

**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 sq. ft. shall be allocated for the feet of each seated passenger that protrudes into the standee area.

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

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

**Gross Battery Capacity.** Gross capacity would be measured in kWh and would be the energy available from the entire battery pack.

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

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

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

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

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

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

**Hose:** Flexible line.

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

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

**Hybrid Drive System (HDS).** The mechanical and/or electromechanical components, including the PPU and energy storage system, which comprise the traction drive portion of the hybrid propulsion system.

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

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

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

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

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

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

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

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

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

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

**Local Regulations.** Regulations below the state level.

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

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

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

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

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

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

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

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

**Module.** Assembly of individual components



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

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

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

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

**Pipe:** Nonflexible line.

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

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

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

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

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

**Real-Time Clock (RTC).** Computer clock that keeps track of the current time.

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

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

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

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

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

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

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

**NOTE:** An example is the communication that takes place between two or more electronic components with the ability to process and store information.

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

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

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

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

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

**Special Tools.** Tools not normally stocked by the City.

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

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

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

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

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

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

**State of Charge (SOC).** Quantity of electric energy remaining in the battery relative to the maximum rated Amp hour (Ah) capacity of the battery expressed in percent. This is a dynamic measurement used for the energy storage system. A full SOC indicates that the energy storage system cannot accept further charging from the engine driven generator or the regenerative braking system. An absolute SOC is based on total battery capacity at the beginning of useful life. A relative SOC is based on total degraded capacity at the time of measurement. The actual relationship between the SOC and energy stored expressed as a percentage shall be linear.

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

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

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

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

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

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

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

### ***TSE 3. Referenced Publications***

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

### ***TSE 4. Legal Requirements***

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

Buses shall meet all applicable FMVSS and shall accommodate all applicable FMCSR regulations in effect at location of the City and the date of manufacture.

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

### ***TSE 5. Overall Requirements***

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

#### **TSE 5.1 Weight**

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

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

#### **TSE 5.2 Capacity**

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

#### **TSE 5.3 Service Life**

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

#### **TSE 5.4 Maintenance and Inspection**

Scheduled maintenance tasks shall be related and shall be, in accordance with the manufacturer's recommended preventative maintenance schedule (along with routine daily service performed during the fueling operations).

Test ports, as required, shall be provided for commonly checked functions on the bus, such as air intake, exhaust, hydraulic, pneumatic, charge-air and engine cooling systems.

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

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

The successful Offeror shall provide a list of all special tools and pricing required for maintaining this equipment. Said list shall be submitted as a supplement to the Pricing Schedule.



**NOTE:** Tools such as compartment door keys, bellows gauges and other tools that are required for daily maintenance and inspections shall not be included in the special tool list and shall be furnished for each coach.

### **TSE 5.5 Interchangeability**

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

Any one component or unit used in the construction of these buses shall be an exact duplicate in design, manufacture and assembly for each bus in each order group in the contract resulting from this RFP. The successful Offeror shall identify and secure approval for any changes in components or unit construction provided within the contract resulting from this RFP.

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

The City shall review proposed product changes on a case-by-case basis and shall have the right to require extended warranties to ensure that product changes perform as least as well as the originally supplied products.

### **TSE 5.6 Training**

The successful Offeror shall have at least one qualified instructor who shall be available at the City's property for five (5) calendar days between the hours of 8:00 a.m. and 5:00 p.m. per month for one (1) month prior to, and up to eighteen (18) months after, acceptance of the first bus. The total hours of instruction shall not exceed 120 hours. Instructor(s) shall conduct schools and advise the personnel of the City on the proper operation and maintenance of the equipment. The successful Offeror also shall provide visual and other teaching aids (such as manuals, slide presentations and literature) for use by the City's own training staff and which become the property of the City.

### **Technical/Service Representatives**

The successful Offeror shall, at its own expense, have one or more competent technical service representatives available on request to assist the City 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 successful Offeror of responsibilities under the provisions of "Section 7: Warranty Requirements."

### **TSE 5.7 Operating Environment**

The bus shall achieve normal operation in ambient temperature ranges of 10 °F to 115 °F, at relative humidity between 5 percent and 100 percent, and at altitudes up to 3000 feet above sea level. Degradation of performance due to atmospheric conditions shall be minimized at temperatures below 10 °F, above 115 °F or at altitudes above 3000 feet. Altitude requirements above 3000 feet will need separate discussions with the engine manufacturer to ensure that performance requirements



are not compromised. Speed, gradability and acceleration performance requirements shall be met at, or corrected to, 77 °F, 29.31 in. Hg, dry air per SAE J1995.

### **TSE 5.8 Noise**

#### **Interior Noise**

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

The bus-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 80 dBA. The driver area shall not experience a noise level of more than 75 dBA.

An exception shall be made for the turntable area, which shall be considered a separate environment.

#### **Exterior Noise**

Airborne noise generated by the bus and measured from either side shall not exceed 80 dBA under full power acceleration when operated 0 to 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dBA. The bus-generated noise at curb idle shall not exceed 65 dBA. If the noise contains an audible discrete frequency, a penalty of 5 dBA shall be added to the sound level measured. The Contractor shall comply with the exterior noise requirements defined in local laws and ordinances identified by the City and SAE J366.

### **TSE 5.9 Fire Safety**

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

### **TSE 5.10 Respect for the Environment**

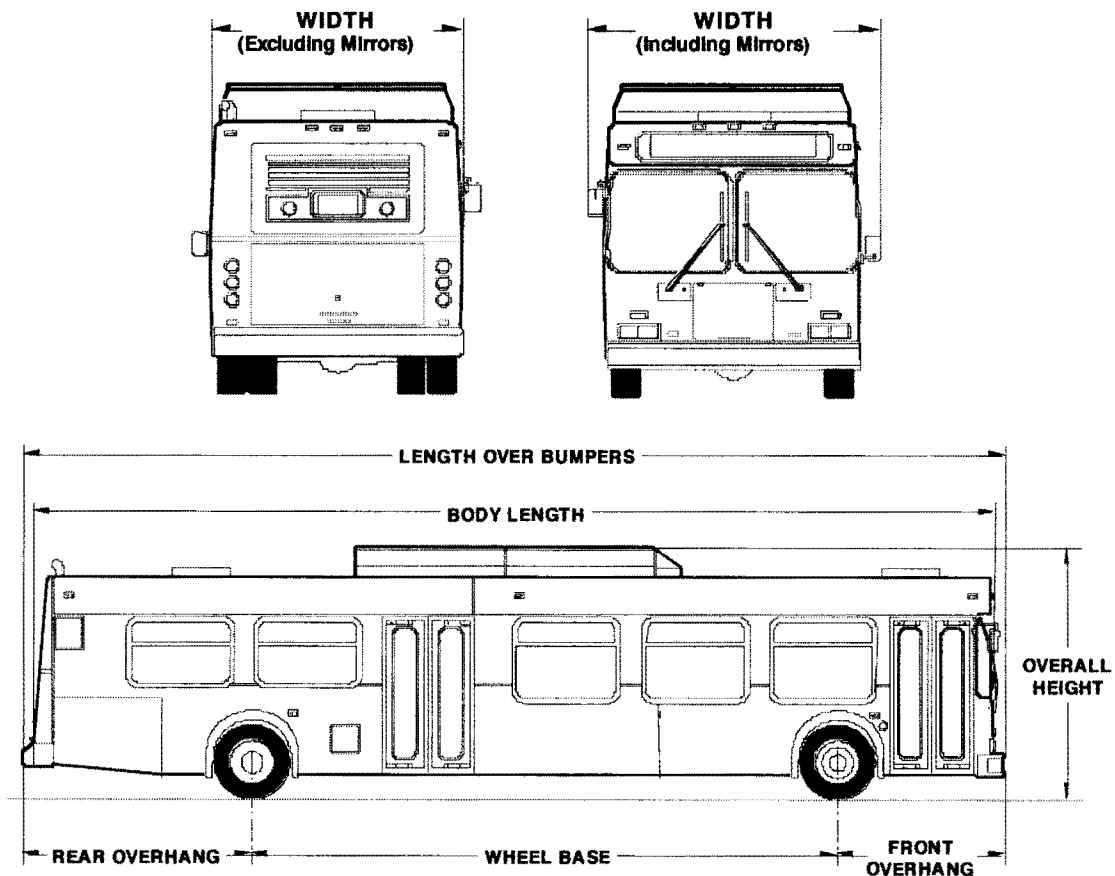
In the design and manufacture of the bus, the Contractor shall make every effort to reduce the amount of potentially hazardous waste. In accordance with Section 6002 of the Resource Conservation and Recovery Act, the Contractor shall use, whenever possible and allowed by the specifications, recycled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

## ***TSE 6. Physical Size***

With exceptions such as exterior mirrors, marker and signal lights, bumpers, fender skirts, washers, wipers, ad frames, cameras, object detection systems, bicycle storage, feelers and rub rails, the bus shall have the following overall dimensions as shown in Figure 1 at static conditions and design height.

## DIMENSIONS

**FIGURE 1**  
Transit Bus Exterior Dimensions



### TSE 6.1 Bus Length

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

- **60-ft BRT bus:** 60 ft. to 64 ft.

### TSE 6.2 Bus Width

102-in. Width Bus

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

### TSE 6.3 Bus Height

Maximum overall height shall be 133 in., including all rigid, roof-mounted items such as A/C, exhaust, fuel system and cover, etc.

**TSE 6.4 Height at Top of the Floor Center Isle all Doors**

The height of the top of the floor at all doors shall be 15.5 inches +/- 0.125 inches, to be equal to the height of all station platforms.

**TSE 6.5 Underbody Clearance**

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

**TSE 6.6 Ramp Clearances**

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

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

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

Angle	60-ft Bus
Approach	9 degrees (min.)
Front breakover	10.2 degrees (min.)
Rear breakover (articulated only)	8.7 degrees (min.)
Departure	9 degrees (min.)

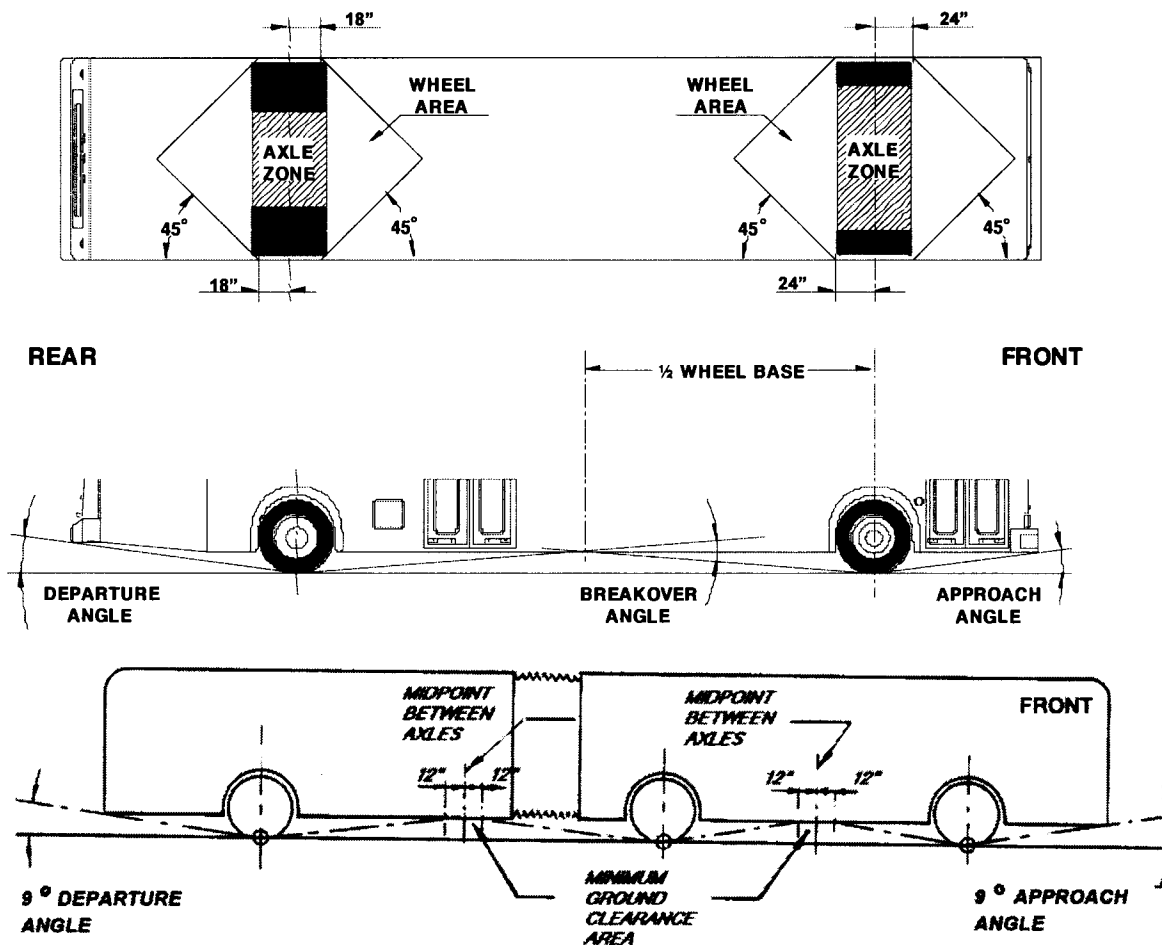
**TSE 6.7 Ground Clearance**

Ground clearance shall be no less than 8 in.) except within the axle zone and wheel area.

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

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

**FIGURE 2**  
Transit Bus Minimum Road Clearance



### TSE 6.8 Floor Height

Height of the step above the street shall be 15.5 in., +/- 0.25 inches measured at the centerline of the doorways. The floor may be inclined along the longitudinal axis of the bus, and the incline shall not exceed 2 degrees off the horizontal except locally at the doors where 2 degree slope toward the door is allowed. All floor measurements shall be with the bus at the design running height and on a level surface and with the standard installed tires. A maximum of two steps is allowed to accommodate a raised aisle floor in the rear of the bus.

### TSE 6.9 Interior Headroom

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

**TSE 6.10 Aisle Width**

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

**VEHICLE PERFORMANCE*****TSE 7. Power Requirements***

The propulsion system shall be sized to provide sufficient power to enable the bus to meet the defined acceleration, top speed, and gradability requirements, and operate all propulsion-driven accessories using actual road test results and computerized vehicle performance data.

**TSE 7.1 Top Speed**

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

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply City with data if there is a variance between peak performance and sustained vehicle performance.

**TSE 7.2 Gradability**

Gradability requirements shall be met on grades with a dry commercial asphalt or concrete pavement at GVWR with all accessories operating. The propulsion system and drivetrain shall enable the bus to achieve and maintain a speed of 40 mph on a 2½ percent ascending grade and 15 mph on a 10 percent ascending grade continuous.

**NOTE:** Values are assumed to be sustained. Manufacturer shall supply City with data if there is a variance between peak performance and sustained vehicle performance.

**TSE 7.3 Acceleration**

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

**TABLE 3**  
Maximum Start Acceleration Times on a Level Surface<sup>1</sup>

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

1. Vehicle weight = GVWR



#### **TSE 7.4 Operating Range**

The operating range of the coach shall be designed to meet the operating profile as follows:

These buses will operate over two routes comprising the Albuquerque Rapid Transit (ART) BRT lines. Both lines operate from the same Central and Unser Transit Center on the west side, while the eastern terminus of one is the Uptown Transit Center and the other runs to Tramway Blvd. The buses will layover for between 5 and 10 minutes at both the east and west terminus locations. The two transit centers are owned and controlled by ABQ RIDE, while the Tramway Blvd terminus is on a public street. These buses are expected to be in operation for 18 hours each day and cover up to 275 miles during the service day.

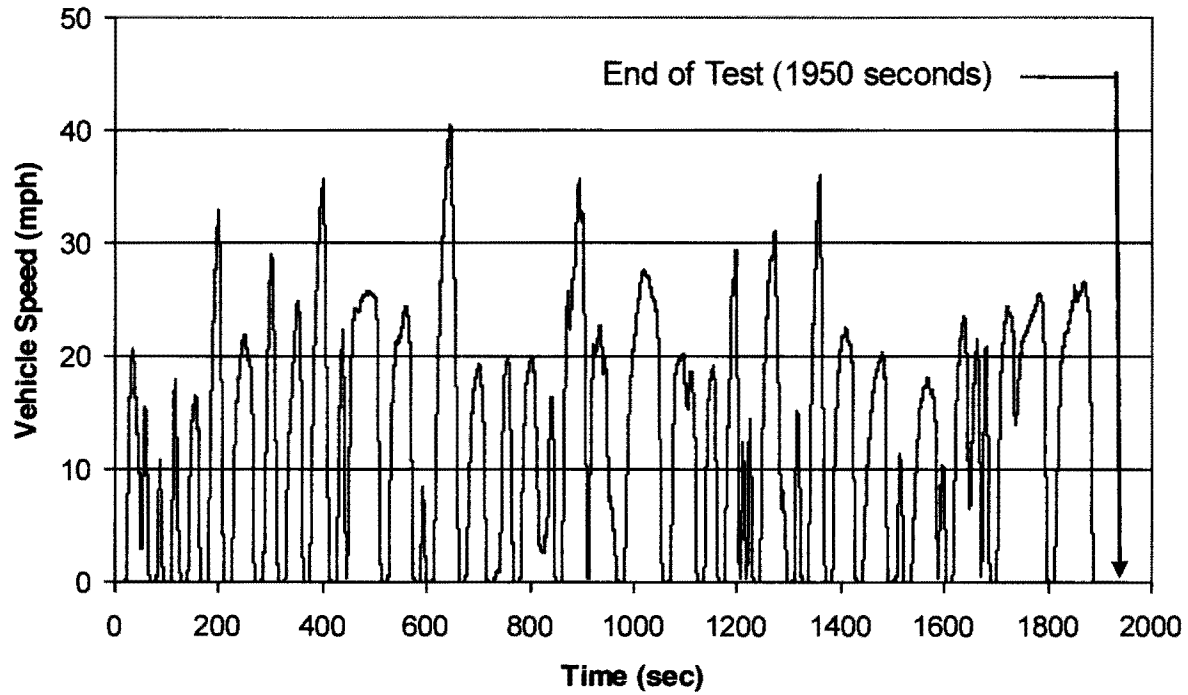
#### ***TSE 8. Fuel Economy (Design Operating Profile)***

Test results from the Altoona fuel economy tests or other applicable test procedures shall be provided to the City. Results shall include vehicle configuration and test environment information. Fuel economy data shall be provided for each design operating profile. The design operating profile is assumed to be defined by the Altoona fuel duty cycle. Miles per gallon (diesel equivalent) are calculated per Altoona fuel economy test procedure using the following relationship:

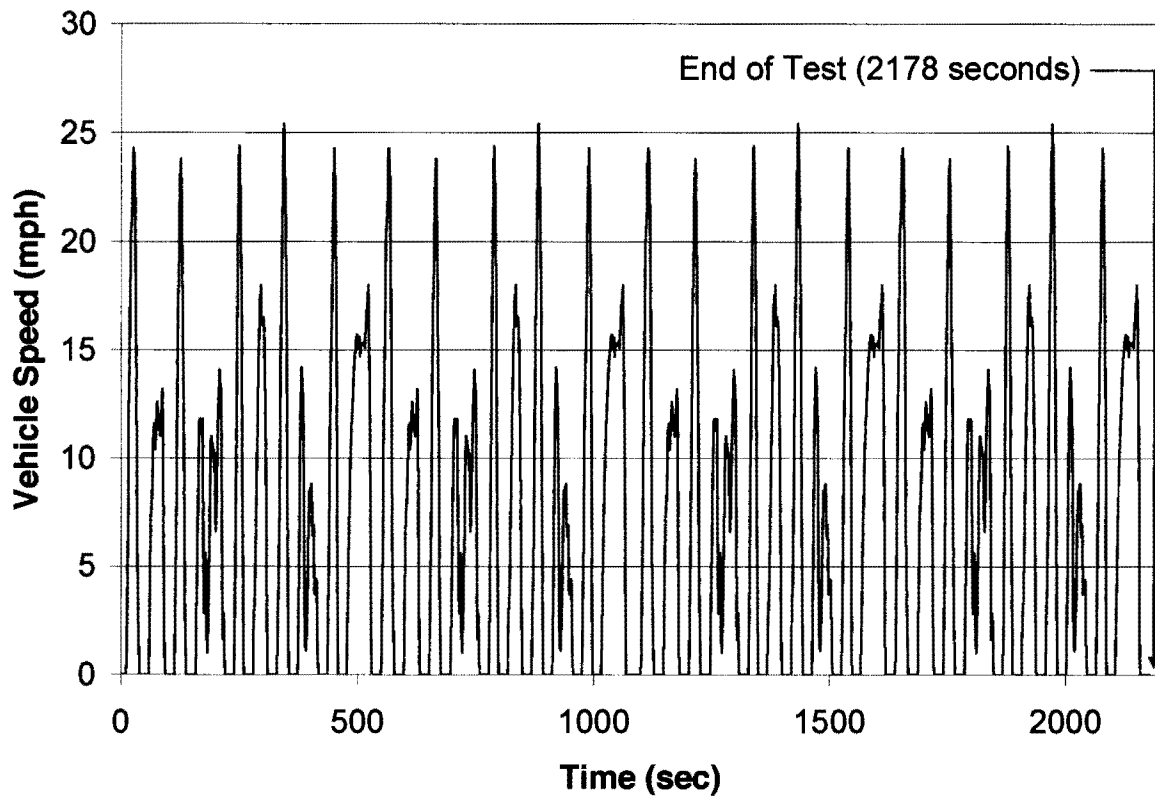
- 1 gallon of diesel = 1.137 gallons of gasoline = 38.2 kWh of Energy

Fuel economy tests shall be run on these four duty cycles.

Duty Cycles: 13 mph  
Manhattan: 6.8 mph  
Orange County: 12.7 mph  
UDDS: 19 mph  
Idle Time



Orange County Bus Cycle



Double Manhattan Bus Cycle

**POWERPLANT****OPTION B: BATTERY ELECTRIC ZERO EMISSION SYSTEM*****TSE 9. Electric Zero Emissions Propulsion System***

The bus shall be powered by a battery electric propulsion system. Function and operation of the bus shall be transparent to the Bus Operator and passengers. The Offeror shall assure that the bus structure can successfully accept the installation of the propulsion system and be operated on the stated duty-cycle for a period of 12 years or 500,000 miles without a structural failure. At a minimum, the propulsion system shall comply with applicable local, state, and/or federal emissions and useful life requirements as a zero emission bus. The propulsion system shall comply with local, state, and federal (maintenance) and other applicable sections. The Electric Drive System shall be rated for the GVWR or greater of the bus.

Maximizing battery life and extending driving range is of the highest priority and therefore to maximize efficiency and eliminate drive line efficiency losses the propulsion motors shall be configured as in wheel motors. The definition of motor in the context of this specification assumes the device can provide or consume electrical energy as well as provide or retard mechanical motion. The traction system shall include the necessary motors, gearing and connection to the wheel motor drive.

**TS 9.1 Propulsion System Controller (PSC)**

The Propulsion System Controller (PSC) regulates energy flow throughout all system components in order to provide motive performance and accessory loads, as applicable, while maintaining critical system parameters (e.g., voltages, currents, temperatures, etc.) within specified operating ranges. The controller shall monitor and process inputs and execute outputs as appropriate to control the operation of all propulsion system components. The overall propulsion system and PSC shall include management of support systems such as, steering, HVAC, defrosters, and cooling systems.

The propulsion system shall be managed via the PSC. This PSC is the hub for all propulsion system device to device communication, to include all traction motors, energy storage, charging equipment, power switching electronics, and interface to other vehicle systems via J1708, J1939. It will protect the traction motors against progressive damage, monitoring conditions critical for safe operation and automatically derate power and/or speed if necessary. The PSC shall provide the following functionalities:

- Storage of the bus data file generated on a day to day basis, to include: duty cycle information (time stamp, vehicle speed, elevation, location, ambient temperature, etc.), energy profile information (i.e., voltage and current from the traction motor, auxiliary systems, Energy Storage System (ESS), power electronics, onboard charging system) at 1 sec intervals. History of charging sessions, energy in, time stamp, State of Charge (SOC), incidents and alarms, system health monitoring and diagnostics information.
- Software capable of "adaptive learning" such that the bus is optimized per duty cycle on the fly to consider, route, day of week and time of day. The objective is to maintain the bus's level of expected performance, and minimize the cost of electricity from our utility used for charging the batteries. If the proposed PSC controller does not have the capability to perform "adaptive learning", the Offeror must perform parameter tuning to help optimize the efficiency of the vehicle to the given route.

- The ability to execute a "limp home" instruction so that the bus is able to return to the depot from the furthest point on the route without charge assistance or towing.
- A wireless means of communication with the charging stations.
- The PSC is assumed to include the necessary sensor inputs at strategic locations, such as, temperature, current, voltage, pressure, etc. so the entire array of devices are monitored in real time. This feature shall be able to execute commands for the self-preservation of component life, health, reliability and safety. The on-board diagnostic system shall trigger a visual and audible alarm to the operator when the motor controller detects a malfunction and the protection systems are activated.
- The PSC shall have an interlock that prevents engagement when the charger is connected to the traction battery. It shall be equipped with an electronically controlled management system, compatible with multiplex wiring systems and either 12- or 24-volt electrical systems.

### ***TSE 9.2 Energy Storage System (ESS)***

The Energy Storage System (ESS) shall be of a commercial design capable of operating in a public transit service environment. The ESS shall be designed, sized, and selected to ensure that the vehicle performance specifications, compatibility with charging, and other related requirements are met or exceeded. The power source for the vehicle shall be derived from an established battery technology purpose built for vehicle propulsion applications that has a field-proven track record of safe, reliable, and durable operation in similar traction applications.

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

The Offeror shall deliver the buses with an installed, fully-charged, fully-functioning ESS. The ESS shall be fully formed, installed and tested in accordance with the battery manufacturer's recommended best practices. The ESS design, including containers, module bracing systems, thermal-management systems, battery-management systems, watering/venting systems, interconnections, fusing, and traction-controller and charger interfaces shall be completely described in the proposal. The proposal shall include a detailed analysis of expected battery performance in the Design Operating Profile. The proposal shall also include a 12 year warranty and a comprehensive statement of the warranty terms relating to the batteries, including explanation of all disclaimers within the warranty. The charge cycle and cycle life shall be stated in the proposal and a life-cycle cost analysis of the proposed battery system in the specified application shall be provided. The ESS shall be capable of withstanding the high current and voltage profiles necessary to accomplish daily recharge events without reducing the life of the battery. Thermal management will be provided to ensure optimal life and performance of the ESS over the environmental operating range.

The ESS shall be adequate to maintain the battery within the battery manufacturer's recommended temperature range during operation in the specified duty cycle and climatic conditions. Proposals shall include complete descriptions of all life-cycle testing procedures used

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

The system shall include a sub-system capable of monitoring the level of connectivity between all propulsion components and associated cabling / connectors to the buses chassis and low (12/24 vdc) systems to insure isolation. The ESS shall have at least two automatic means or devices to disconnect, and one manual means capable of interrupting the positive and negative connections within the module enclosure, and rated for disconnect at maximum current.

***TSE 9.3. Energy Storage System Safety***

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

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

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

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

***TSE 9.4. Battery Containers***

Battery containers shall be constructed to withstand the rigors of public transit service for the design life of the buses. Construction shall be of materials compatible with the battery electrolyte. All electrical connections shall be fully shielded and hand operable. Connector and cabling design shall be such that inappropriate or unsafe connections are not physically possible.

The system shall be designed to allow a single mechanic using a 2-ton capacity forklift to remove and replace batteries from a container within 15 minutes. Vent and fill system components for individual packs or containers shall not require any disassembly on removal or installation of the battery packs or containers. Pack design must ensure the protection of battery cabling and vent/watering system components during pack removal and installation. The batteries, when installed, shall be secured to prevent any movement while the vehicle is in operation.



the Offeror are also acceptable provided that such containers are certified by battery manufacturer; such certification shall be submitted to the City concurrent with or prior to delivery of the Pilot bus.

***TSE 9.5. Battery Management System (BMS)***

As a minimum, the battery management system (BMS) must perform the following functions: The BMS system must be capable of monitoring the voltage level of cells within each battery pack. The BMS must be able to read and store individual battery or block voltages at a frequency of 1 data point per block every 15 seconds. The system must also monitor battery pack temperatures using no fewer than 2 thermocouples placed in and around each battery pack sampled at the same 4 samples per minute frequency.

The BMS system must be capable of communicating when a battery fault (as defined by the battery manufacturer) has occurred and must be able to identify and communicate information about the faulty battery in order that maintenance can be performed. The BMS system must be capable of engaging prudent safety interlocks when an unsafe battery condition has been detected. The BMS system must be able to monitor the battery state-of charge and update a gauge viewed by the operator at least once every 15 seconds. The BMS system must be able to communicate all data to the bus level information system for storage and communication.

***TSE 9.6. Battery Thermal Management***

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

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

***TSE 9.7 Spare Motors***

Two new traction motors shall be shipped with this order as spares.

**CHARGING STATIONS**

***TSE 9.8. Charging Infrastructure***

These general requirements apply to all charging stations that may be delivered under the Contract. The Offeror shall provide Charging Equipment, Charger Interface and the control and data systems needed to recharge the bus propulsion system batteries. The subject equipment deliverables shall begin downstream of the electric service meter, and shall include the main service panel, sub-panels, step/down transformers, all circuit breakers and disconnect switches. The Offeror shall provide all Charging Equipment and Charger Interface design requirements, specifications and engineering drawings to the City to enable Charging Station site design, permitting, and construction.

The Offeror shall provide close coordination with the Agency and its engineering Offerors during site design and construction of the charging stations. The Offeror shall be responsible for equipment start-up and testing to ensure that the charging equipment meets all stated specifications and functionality prior to acceptance.

The chargers shall be UL Classified for the intended purpose location and environment. The charging systems shall be capable of delivering the optimal battery charge profile as specified by the battery manufacturer and charging the installed traction battery to a fully charged state from the minimum recommended state-of-charge including any necessary cool-down time as specified by the battery manufacturer. The chargers shall be capable of connection to a 480-volt, 3-phase, 60 Hz electrical supply. The chargers shall be equipped with an E-Mon Class 3200 submeter (or approved equal) that: measures and displays kWh consumed and real time load in KW within 1% accuracy, is capable of RS-485 communications and, records kWh and kVARh delivered, kWh and kVARh received. Data shall be stored in 15-minute intervals for up to 72 days or 5-minute intervals for up to 24 days. The system will maintain interval data storage in a first-in, first-out format.

Battery chargers shall be configured to automatically apply a charging protocol appropriate to the battery's state-of-charge (SOC), in accordance with the battery manufacturer's recommended practices. The battery charger shall be configured to automatically initiate and sustain charging at any battery state-of-charge if properly connected when so signaled by an external timing circuit or control input. The battery charger shall be configured to automatically terminate the charge on attainment of a full state-of-charge or in the event of hazardous or anomalous conditions. Battery chargers shall be able to apply commissioning, equalization or conditioning charges according to the battery manufacturer's recommended practices when so configured by operation of keyboard or switch panel inputs. The battery charger shall be configured to automatically restart after unintended interruption of a charging episode due to interruption or temporary degradation of electrical service. The battery chargers shall be configured to interface with on-board battery management and interlock systems.

The actual charge profiles that the subject chargers will deliver while charging, commissioning, equalizing, and conditioning the battery systems of the subject buses shall be submitted to the battery manufacturer for review and approval. Written confirmation from the battery manufacturer attesting to the appropriateness of the delivered charge profile shall be submitted to the City concurrent with or prior to delivery of the Pilot bus.

The buses must be immobilized during all charging operations. Upon successful engagement of the charging interface, the bus shall be interlocked such that propulsion is rendered non-tractive and the brakes applied.

Conductive cabling connecting depot and convenience chargers to the bus shall be of fifteen-foot (max) length and shall connect to a receptacle at the front of the bus, curb side. The connectors shall be industry standard and of simple design and heavy-duty construction and shall not be energized except when mated with the bus mounted receptacle. A single bus mounted receptacle shall serve both the depot charging stations and the On Route charging stations. The bus mounted receptacle shall be of simple and ergonomic design, of not more than 25 pounds (plug and cord), not more than two plugs.

Chargers shall not produce harmonic distortion in excess of 5% THD. Charging circuits shall be isolated from the vehicle chassis such that ground current from the grounded chassis does not exceed 5 mA.

The bid package shall contain a complete description of the charging systems (including anticipated AC energy consumption for buses operating on the specified operating profile, power factors, harmonic distortion, and accuracy of charge parameters).

#### ***TSE 9.8.1. Depot Charging Stations***

Offeror's charging equipment shall be installed at the Agency bus depot for overnight charging and conditioning of the batteries. Offeror shall provide charging equipment to allow for simultaneous charging of all buses purchased under this RFP. Any equipment associated with the Charging Station must be vandal-resistant and weatherproof.

Offeror may vary the size of the Charging Equipment at the Agency bus depot to allow for overnight charging and battery conditioning with a maximum charge time of four hours, per bus.

Buses shall be charged to Maximum Standard Operating SOC at a rate that maximizes life of the batteries.

The Charging Interface may be conductive or inductive. The Charging Interface shall be a design that is considered "industry standard" with respect to the connector to the charging equipment, connector to the bus, connection methods, communications protocol, and data exchanged between the charging equipment and the vehicle. In the event that no industry standard exists, the Agency shall have the right to license the design of the Charging Interface to allow for the Charging Interface to be used with alternate charging equipment and bus manufacturers.

The depot chargers shall be capable of discharging the on-board energy storage system to facilitate making repairs the preferred means of discharge shall be to return the power to the utility grid.

#### ***TSE 9.8.2. On Route Charging Stations***

If required by proposed battery electric bus service solution, Offeror's charging equipment shall be installed at Charging Stations on the selected routes to enable charging of the bus while exchanging passengers at a scheduled stop(s). Offeror shall provide charging equipment for a minimum of two Charging Stations for each selected route. Each charging station will be limited to charging one electric bus at a time.

Buses shall be scheduled to stop for a maximum of 5-10 minutes at each Charging Station, including time to engage and disengage the charging interface. The charging equipment must be sized to recharge the batteries to allow buses to operate on the selected route described in the operating profile. It is assumed that buses will start daily duty cycle at 100% SOC. Operation of the Charging Station must be programmable to control charging based on user specified time periods. This feature must be available through the Charge Management System (CMS).

Termination of the charging process shall be executed either by the bus driver or, automatically upon reaching a user specified SOC, or user pre-programmed time period (i.e. 10 minutes).

The Charging Interface may be conductive or inductive. The Charging Interface, which supplies electricity between the charging equipment and the bus, shall be a design that is considered "industry standard" with respect to the connector to the charging equipment, connector to the bus, connection methods, communications protocol, and data exchanged between the charging equipment and the vehicle. In the event that no industry standard exists, the Agency shall have the right to license the design of the Charging Interface to allow for the Charging Interface to be used with alternate charging equipment and bus manufacturers.

The Charging System must include the following protections and driver alerts: (i) dynamic state of charge of the Energy Storage System, (ii) charge rate, and (iii) fault codes for Charging System failure alerting the operator to the severity of the fault.

The bus must be immobilized during all charging operations and hotel loads must be capable of operation. Upon successful engagement of the charging interface, the bus shall be interlocked such that propulsion is rendered non-tractive and the brakes applied, until the end of the programmed cycle or, manually stopped by the driver.

Offeror shall provide alternative manual charging capability in the event of failure of the primary charging interface. The bus should be equipped with at least one manual charger port connection suitable for use in emergency situations at the on route charging station.

The charging station, including the charging interface, charging equipment, and supporting components and systems shall not interfere with the normal operation of the bus, passengers, pedestrians, or other vehicular traffic. Any equipment associated with the charging station must be vandal-resistant and weatherproof.

Charging station equipment must be compliant with all local public right-of-way regulations.

The bid package shall contain a complete description of the Charging System including principle of operation, equipment components, component specifications, IP/UL protection classes, industry standard testing protocols and results, environmental requirements, general installation requirements, etc.

#### ***TSE 9.8.3. Charge Management System (CMS)***

The Depot Charging Stations shall be capable of being controlled and scheduled by a centralized charger management system that allows a user to control charging start and stop times, charging SOC, etc. for each charger on the system.

#### ***TSE 9.8.4. Wireless Communication System***

The Charging Stations shall be equipped with a wireless communication system to transmit information on each charge event, including, but not limited to bus ID, charger status, faults, beginning SOC, charge amount, ending SOC, charge duration, energy consumption at the Mains Supply, energy consumption at the charge interface, max power, ambient temperature, etc.

#### ***TSE 9.8.5. High Level Management System (HLMS)***

The High Level Management System (HLMS) shall collect data from each component within the system, including the PSC, BMS and CMS and provide summary reports, such as utility, energy, charging profiles, health checks, alarms, mileage, etc. The high level controller shall also be the



point of transferring instruction and re-programming to the charging station and buses. The proposer shall provide a complete list of data elements reportable from charging stations and buses, respectively.

#### ***TSE 9.8.6. Bus Management System (BMS)***

The Bus Management System (BMS) shall manage the propulsion system controller (PSC) on board each bus and store data records representing the propulsion system activity at 1 second intervals, such as duty cycle information (time, location, altitude, speed), voltage and current input and output for major electrical components (ESS, power converters, HVAC), traction motor input voltage and current, traction motor output torque and rotational speed, system health, BMS information, and faults. The on-board system shall be capable of profiling energy consumption, tractive energy, regenerative braking and hotel loads, such as, lighting, HVAC and support system loads, such as, steering, fans, cooling, air, system faults, etc. Bus data shall be communicated to each on route charging system throughout the day during the charging session, and to the HLMS upon returning to the depot for overnight charging of the batteries. This on-board system shall also be capable of storing one week of all data and reports in memory that can be downloaded from the bus using a standard laptop computer.

#### ***TSE 10. Cooling Systems***

The cooling systems shall be of sufficient size to maintain the traction motors and electronics at safe continuous operating temperatures during the most severe operations and conditions possible and in accordance with the power electronics system component manufacturers' cooling system requirements and recommendations. The cooling system fan control should sense the temperatures of the operating fluids and intake air and if either is at or above the recommended operating conditions the cooling fan should be engaged. The fan control system shall be designed with a fail-safe mode of "fan on." The cooling system shall have an ambient capacity of at least 120° F with water as coolant at 5,000 feet above sea level operation.

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

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

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

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



The cooling system is assumed for all temperature control required for the propulsion system, the ESS, heating and cooling. Heat from this system may also be used to provide thermal energy as required for vehicle functions, as HVAC and defroster. Coolant shall be compliant with the component manufacturer's specifications.

#### **TSE 10.1 Traction Motors Cooling**

The cooling system will provide all necessary cooling to the tractions motors. Motor temperature sensors shall be easily accessible for replacement. Motor temperature sensors shall not disable the bus at any time.

#### **TSE 10.2 Electric Drive System Cooling**

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

#### **TSE 10.3 Transmission Cooling**

Not required.

#### ***TSE 11. Transmission (Conventional Powertrain)***

Not required.

#### **TSE 11.1 Spare Transmission**

Not required.

#### ***TSE 12. Retarder***

The powertrain shall be equipped with a retarder designed to extend brake lining service life. The application of the retarder shall cause a smooth blending of both retarder and service brake function and shall activate the brake lights.

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

#### **Standard Requirement for Retarder Activation**

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

#### ***TSE 12.1 Regenerative brake management***

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

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

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

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

The regenerative braking shall be adjustable within the limits of the powertrain and activated when the brake pedal is depressed or upon release of accelerator pedal. Any time the bus is coasting or slowing down the brake lights shall turn on, with or without regenerative braking engaged.

### ***TSE 13. Mounting***

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

#### ***TSE 13.1 Propulsion System Service***

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

### ***TSE 14. Hydraulic Systems***

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

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

#### ***Hydraulic System Sensors***

Sensors in the main hydraulic system, including those in the power steering system, shall indicate on the driver's on-board diagnostic panel conditions of low hydraulic fluid level.

#### ***TSE 14.1 Fluid Lines***

All lines shall be rigidly supported to prevent chafing damage, Fatigue Failures, degradation and tension strain. Lines should be sufficiently flexible to minimize mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be protected by grommets (or similar devices) that fit snugly to both the line and the perimeter of the hole that the line passes

through to prevent chafing and wear. Pipes and fluid hoses shall not be bundled with or used to support electrical wire harnesses.

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

All hoses, pipes, lines and fittings shall be specified and installed per the manufacturer's recommendations.

#### **TSE 14.2 Fittings and Clamps**

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

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

#### **TSE 14.3 Charge Air Piping**

Not required.

#### ***TSE 15. Radiator***

Not required.

#### ***TSE 16. Oil and Hydraulic Lines***

Hydraulic lines shall be compatible with the substances they carry. The lines shall be designed and intended for use in the environment where they are installed. For example, resistant to road salts near the road surface, and so on. Lines within the engine compartment shall be composed of steel tubing where practicable, except in locations where flexible lines are required.

Hydraulic lines of the same size and with the same fittings as those on other piping systems of the bus, but not interchangeable, shall be tagged or marked for use on the hydraulic system only.

#### ***TSE 17. Fuel***

##### **TSE 17.1 Fuel Lines**

Not required.

##### **TSE 17.2 Design and Construction**

###### **TSE 17.2.1 Design and Construction, CNG**

Not required.

##### **TSE 17.3 Diesel Fuel Tank**

Not required.

## ***TSE 18. Emissions and Exhaust***

### **TSE 18.1 Exhaust Emissions**

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

### **TSE 18.2 Exhaust System**

Not required.

### **TSE 18.3 Exhaust After treatment**

Not required.

### **TSE 18.4 Particulate Aftertreatment**

Not required.

## **STRUCTURE**

### ***TSE 19. General***

#### **TSE 19.1 Design**

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

### ***TSE 20. Altoona Testing***

#### **Altoona Test Report Provided to City as Part of Bid Package**

Prior to responding to the Request for Bids, the structure of the proposed bus model shall have undergone appropriate structural testing and/or analysis, including the complete regimen of FTA required Altoona tests. As part of its bid submittal, the OEM shall provide the City with a completed report of Altoona testing for the proposed bus model along with a plan of corrective action to address deficiencies, breakdowns and other issues identified during Altoona testing. The bus model tested shall match the bus model proposed for procurement, including structure, axles and drive-train. Base model and partial Altoona test reports are acceptable when the combination of these tests adequately represents the proposed bus model. Bid submittals lacking completed reports of Altoona testing will be deemed unresponsive.

#### **TSE 20.1 Structural Validation**

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

The structure of the proposed bus model shall have undergone structural testing prior to assembly of the first bus. The OEM shall provide the City with completed reports of other structural tests as specified by the City.

### ***TSE 21. Distortion***

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

## ***TSE 22. Resonance and Vibration***

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

### **TSE 22.1 Engine Compartment Bulkheads**

Not required.

### **TSE 22.2 Crashworthiness**

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

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

Exterior panels below 35 in. from ground level shall withstand a static load of 2000 lbs applied perpendicular to the bus by a pad no larger than 5 sq in. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the bus.

## ***TSE 23. Corrosion***

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

All materials that are not inherently corrosion resistant shall be protected with corrosion-resistant coatings. All joints and connections of dissimilar metals shall be corrosion resistant and shall be protected from galvanic corrosion. Representative samples of all materials and connections shall withstand a two-week (336-hour) salt spray test in accordance with ASTM Procedure B-117 with no structural detrimental effects to normally visible surfaces and no weight loss of over 1 percent.

### **Corrosion Resistance Requirements for Exposed and Interior Surfaces of Tubing Throughout Entire Vehicle**

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

## ***TSE 24. Towing***

Towing devices shall be provided on the front end of the bus. Each towing device shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20 degrees of the longitudinal axis of the bus. If applicable, the rear towing device(s) shall not provide a toehold for unauthorized riders. The method of attaching the towing device shall not require the removal, or disconnection, of front suspension or steering components.

A plug connector permanently mounted at the front of the bus shall provide for bus tail lamp, marker, stop and turn signal lamp operation as controlled from the towing vehicle. The connector shall include a spring-



loaded dust- and water-resistant cap. Shop air connectors shall be provided at the front and rear of the bus and shall be capable of supplying all pneumatic systems of the bus with externally sourced compressed air. The location of these shop air connectors shall facilitate towing operations.

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

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

Two rear recovery devices/tie downs shall permit lifting and towing of the bus for a short distance, such as in cases of an emergency, to allow access to provisions for front towing of bus. The method of attaching the tow bar or adapter shall require the specific approval of the City. Any tow bar or adapter exceeding 50 lbs. should have means to maneuver or allow for ease of use and application. Each towing device shall accommodate a crane hook with a 1 in. throat.

#### ***TSE 25. Jacking***

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

#### **Yellow Pads**

Jacking pads shall be painted safety yellow.

#### ***TSE 26. Hoisting***

The bus axles or jacking plates shall accommodate the lifting pads of a two-post hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.

#### ***TSE 27. Floor***

##### **TSE 27. 1 Design**

The floor shall be essentially a continuous plane, except at the wheel housings and platforms. Where the floor meets the walls of the bus, as well as other vertical surfaces such as platform risers, the surface edges shall be blended with a circular section of radius not less than ¼ in. or installed in a fully sealed butt joint. Similarly, a molding or cover shall prevent debris accumulation between the floor and wheel housings. The vehicle floor in the area of the entrance and exit doors shall have a lateral slope not exceeding 2 degrees to allow for drainage.

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

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

**TSE 27.2 Strength**

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

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

**TSE 27.3 Construction**

The floor shall consist of the subfloor and the floor covering that will last the life of the bus. The floor as assembled, including the sealer, attachments and covering, shall be waterproof, non-hygroscopic and resistant to mold growth. The subfloor shall be resistant to the effects of moisture, including decay (dry rot). It shall be impervious to wood-destroying insects such as termites.

**Pressure-Preserved Plywood Panel**

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

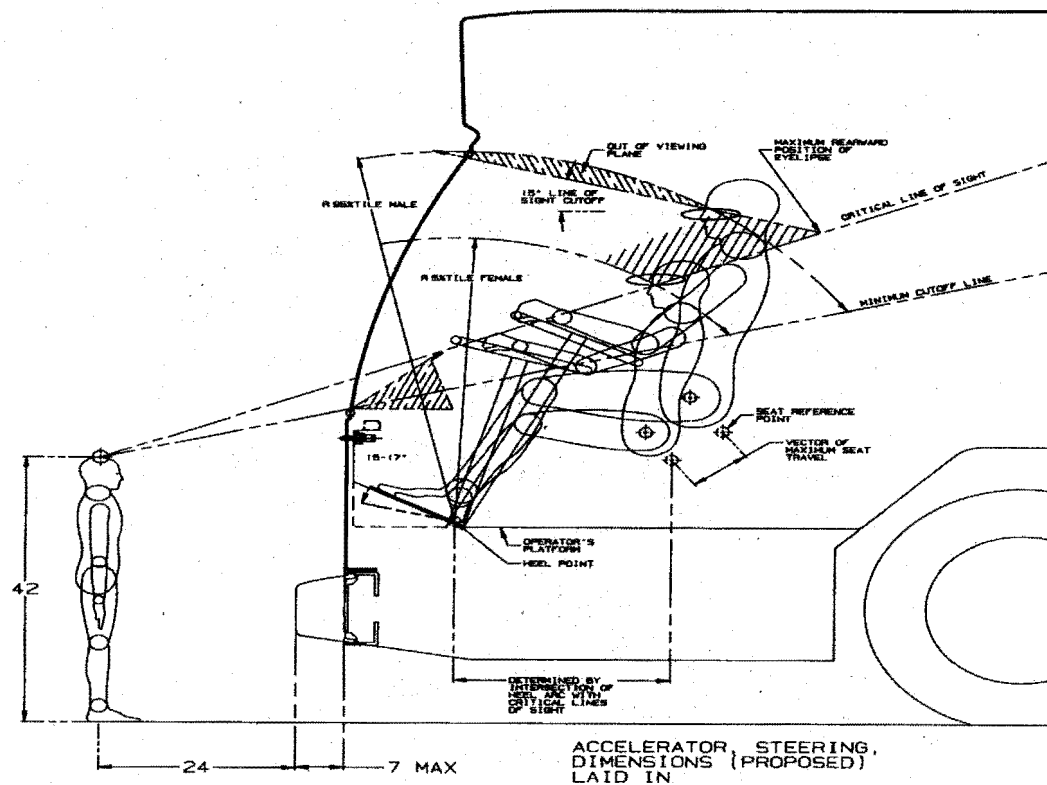
***TSE 28. Platforms*****TSE 28.1 Driver’s Area**

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

**TSE 28.2 Driver’s Platform**

The driver’s platform shall be of a height such that, in a seated position, the driver can see an object located at an elevation of 42 in. above the road surface, 24 in. from the leading edge of the bumper. Notwithstanding this requirement, the platform height shall not position the driver such that the driver’s vertical upward view is less than 15 degrees. A warning decal or sign shall be provided to alert the driver to the change in floor level. Figure 3 illustrates a means by which the platform height can be determined, using the critical line of sight.

**FIGURE 3**  
Determining Platform Height



### Farebox

Farebox placement should minimize impact to passenger access and minimize interference with the driver's line of sight. City will provide directional placement of farebox.

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

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

### TSE 28.4 Rear Step Area to Rear Area

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

### TSE 29. Wheel Housing

#### TSE 29.1 Design and Construction

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

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

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

The finish of the front wheel housings shall be scratch-resistant and complement interior finishes of the bus to minimize the visual impact of the wheel housing. If fiberglass wheel housings are provided, then they shall be color-impregnated to match interior finishes. The lower portion extending to approximately 10 to 12 in. above floor shall be equipped with scuff-resistant coating or stainless steel trim.

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

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

## **CHASSIS**

### ***TSE 30. Suspension***

#### **TSE 30.1 General Requirements**

The front, rear and mid (if articulated) suspensions shall be pneumatic type. The basic suspension system shall last the service life of the bus without major overhaul or replacement. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Routine adjustments shall be easily accomplished by limiting the removal or disconnecting the components.

#### **TSE 30.2 Alignment**

All axles should be properly aligned so the vehicle tracks accurately within the size and geometry of the vehicle.

#### **TSE 30.3 Springs and Shock Absorbers**

##### **TSE 30.3.1 Suspension Travel**

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

##### **TSE 30.3.2 Damping**

Vertical damping of the suspension system shall be accomplished by hydraulic shock absorbers mounted to the suspension arms or axles and attached to an appropriate location on the chassis. Damping shall be sufficient to control coach motion to three cycles or less after



hitting road perturbations. The shock absorber bushing shall be made of elastomeric material that will last the life of the shock absorber. The damper shall incorporate a secondary hydraulic rebound stop.

### **TSE 30.3.3 Lubrication**

#### **Standard Grease Fittings**

All elements of steering, suspension and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534. These fittings shall be located for ease of inspection and shall be accessible with a standard grease gun from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. The lubricant specified shall be standard for all elements on the bus serviced by standard fittings and shall be required no less than every 6000 miles.

### **TSE 30.3.4 Kneeling**

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

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

The brake and throttle interlock shall prevent movement when the bus is kneeled. The kneeling control shall be disabled when the bus is in motion. The bus shall kneel at a maximum rate of 1.25 in. per second at essentially a constant rate. After kneeling, the bus shall rise within 3 seconds to a height permitting the bus to resume service and shall rise to the correct operating height within 7 seconds regardless of load up to GVWR. During the lowering and raising operation, the maximum vertical acceleration shall not exceed 0.2g, and the jerk shall not exceed 0.3g/second.

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

## ***TSE 31. Wheels and Tires***

### **TSE 31.1 Wheels**

All wheels shall be interchangeable and shall be removable without a puller. Wheels shall be compatible with tires in size and load-carrying capacity. Front wheels and tires shall be balanced as an assembly per SAE J1986.



### **Painted Steel**

Wheels and rims shall be hub-piloted with metallic silver powder coated steel (maximum 3.5 mil) and shall resist rim flange wear.

### **TSE 31.2 Tires**

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

The tires shall be provided under a lease agreement between the City and the tire supplier and shall be 305/70 R225

### ***TSE 32. Steering***

Hydraulically assisted steering shall be provided. The steering gear shall be an integral type with the number and length of flexible lines minimized or eliminated. Engine driven hydraulic pump shall be provided for power steering.

#### **TSE 32.1 Steering Axle**

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

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

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

The steering geometry of the outside (frontlock) wheel shall be within 2 degrees of true Ackerman up to 50 percent lock measured at the inside (backlock) wheel. The steering geometry shall be within 3 degrees of true Ackerman for the remaining 100 percent lock measured at the inside (backlock) wheel.

#### **TSE 32.2 Wheel**

##### **TSE 32.2.1 Turning Effort**

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

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

Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 lbs at the steering wheel rim, and perceived free play in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

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

**TSE 32.2.2 Steering Wheel, General**

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

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

**TSE 32.2.3 Steering Column Tilt**

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

**TSE 32.2.4 Steering Wheel Telescopic Adjustment**

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

**TABLE 5**  
Steering Wheel Height<sup>1</sup> Relative to Angle of Slope

At Minimum Telescopic Height Adjustment (29 in.)		At Maximum Telescopic Height Adjustment (5 in.)	
Angle of Slope	Height	Angle of Slope	Height
0 degrees	29 in.	0 degrees	34 in.
15 degrees	26.2 in.	15 degrees	31.2 in.
25 degrees	24.6 in.	25 degrees	29.6 in.
35 degrees	22.5 in.	35 degrees	27.5 in.

1. Measured from bottom portion closest to driver.

**TSE 33. Drive Axle**

The bus shall be driven by a heavy-duty axle with a load rating sufficient for the bus loaded to GVWR. The drive axle shall have a design life to operate for not less than 300,000 miles on the design operating profile without replacement or major repairs. The lubricant drain plug shall be magnetic type. If a planetary gear design is employed, the oil level in the planetary gears shall be easily checked through the plug or sight gauge. The axle and driveshaft components shall be rated for both propulsion and retardation modes with respect to duty cycle.

**NOTE:** The retardation duty cycle can be more aggressive than propulsion.

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

**TSE 33.1 Non-Drive Axle**

The non-drive axle is the drive axle without the drive gear with a load rating sufficient for the load to GVWR.

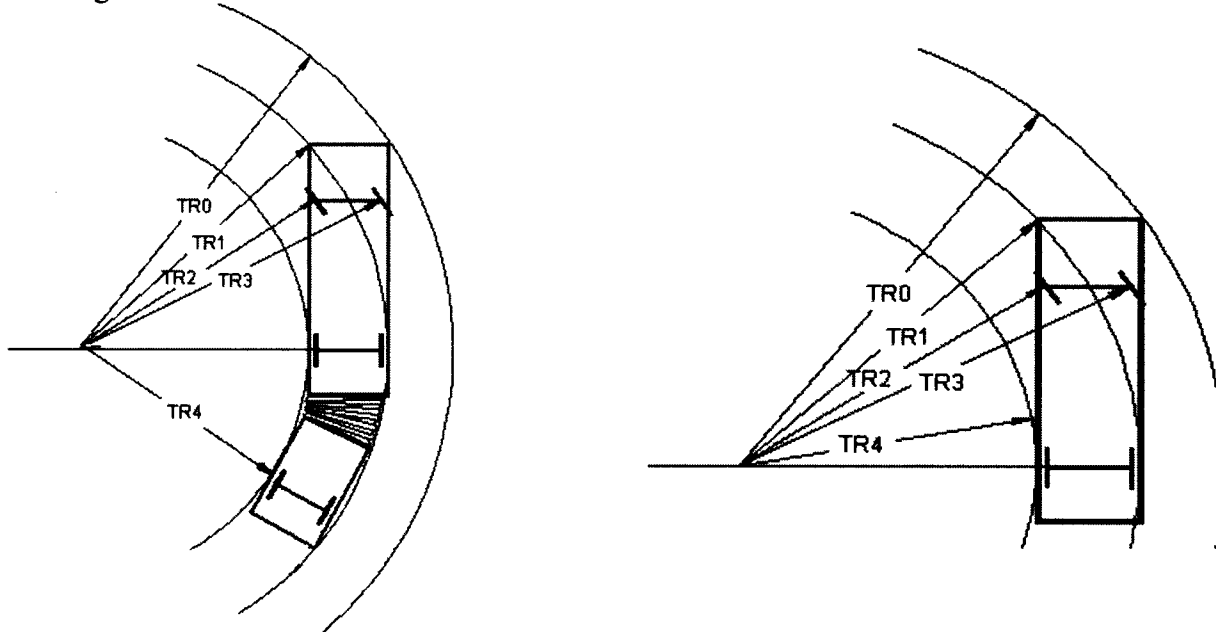
**TSE 34. Turning Radius**

**TABLE 4**  
Maximum Turning Radius

Bus (approximate)	Length	Maximum (see Figure 4)	Turning Radius
60 ft		44 ft. (TR0)	

**FIGURE 4**

Turning Radius

**TSE 35. Brakes****TSE 35.1 Service Brake**

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

**TSE 35.2 Actuation****Air-Actuated Brakes**

Service brakes shall be controlled and actuated by a compressed air system. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 70 lbs at a point 7 in. above the heel point of the pedal to achieve maximum braking. The heel point is the location of the driver's heel when his or her foot is rested flat on the pedal and the heel is touching the floor or heel pad of the pedal. The ECU for the ABS system shall be protected, yet in an accessible location to allow for ease of service.

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

No automatic traction control.

### **TSE 35.3 Friction Material**

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

### **TSE 35.4 Hubs and Drums**

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

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

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

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

### **TSE 35.5 Parking/Emergency Brake**

#### **Air Brakes**

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

### **TSE 35.6 Electronic Brake Monitoring System**

Each bus is to include a brake monitoring as part of the vehicle air disc braking on-board diagnostic system. The Brake Monitoring System (BMS) shall monitor both parking brakes and service brakes. The BMS system shall be designed to detect over-stroke, non-functioning, brake drag and low pad-to-rotor clearance conditions at each vehicle wheel end.

Any wheel-end brake fault condition detected by the BMS shall be communicated via SAE brake fault codes over the vehicle J-1939 network in real-time. These predefined fault codes shall provide instant warnings to operations and maintenance of critical brake system problems which may affect the safe operation of vehicle.

The on-board BMS shall be designed to augment safety and to aid maintenance in determining when to perform necessary unscheduled maintenance to address vehicle performance or safety concerns in a timely manner. The system shall provide a log of stored fault codes for later retrieval by maintenance personnel to be utilized by maintenance personnel for vehicle troubleshooting.

## ***TSE 36. Interlocks***

### **TSE 36.1 Passenger Door Interlocks**

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

To preclude movement of the bus, an accelerator interlock shall lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus when the driver's door control is moved to a mid/rear door enable or open position, or a mid or rear door panel is opened more than 3 in. from the fully closed position (as measured at the leading edge of the door panel). The interlock engagement shall bring the bus to a smooth stop and shall be capable of holding a fully loaded bus on a 6 percent grade, with the engine at idle and the transmission in gear, until the interlocks are released. These interlock functions shall be active whenever the vehicle Master Run Switch is in any run position.

All door systems employing brake and accelerator interlocks shall be supplied with supporting failure mode effects analysis (FEMA) documentation, which demonstrates that failure modes are of a failsafe type, thereby never allowing the possibility of release of interlock while an interlocked door is in and unsecured condition, unless the door master switch has been actuated to intentionally release the interlocks.

Braking effort adjustable with hand tools.

No requirements for accelerator and brake interlocks whenever front doors are open.

#### **Requiring Accelerator Interlock Whenever Rear Doors Are Open**

An accelerator interlock shall lock the accelerator in the closed position, and a brake interlock shall engage the service brake system to stop movement of the bus whenever the middle or rear doors are open.

### ***TSE 37. Pneumatic System***

#### **TSE 37.1 General**

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

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

#### **TSE 37.2 Air Compressor**

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

#### **TSE 37.3 Air Lines and Fittings**

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

**Green:** Indicates primary brakes and supply.

**Red:** Indicates secondary brakes.



**Brown:** Indicates parking brake

**Yellow:** Indicates compressor governor signal.

**Black:** Indicates accessories.

Line supports shall prevent movement, flexing, tension, strain and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. To the extent practicable and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5-ft intervals. Nylon lines may be grouped and shall be supported at 30 in. intervals or less.

The compressor discharge line between powerplant and body-mounted equipment shall be flexible convoluted copper or stainless steel line, or may be flexible Teflon hose with a braided stainless steel jacket. Other lines necessary to maintain system reliability shall be flexible Teflon hose with a braided stainless steel jacket. End fittings shall be standard SAE or JIC brass or steel, flanged, swivel-type fittings. Flexible hoses shall be as short as practicable and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 2-ft intervals or less.

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

#### **TSE 37.4 Air Reservoirs**

All air reservoirs shall meet the requirements of FMVSS Standard 121 and SAE Standard J10 and shall be equipped with drain plugs and guarded or flush type drain valves. Major structural members shall protect these valves and any automatic moisture ejector valves from road hazards. Reservoirs shall be sloped toward the drain valve. All air reservoirs shall have drain valves that discharge below floor level with lines routed to eliminate the possibility of water traps and/or freezing in the drain line.

#### **TSE 37.5 Air System Dryer**

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

No requirements for additional oil separator provision.

## **ELECTRICAL, ELECTRONIC AND DATA COMMUNICATION SYSTEMS**

### ***TSE 38. Overview***

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

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

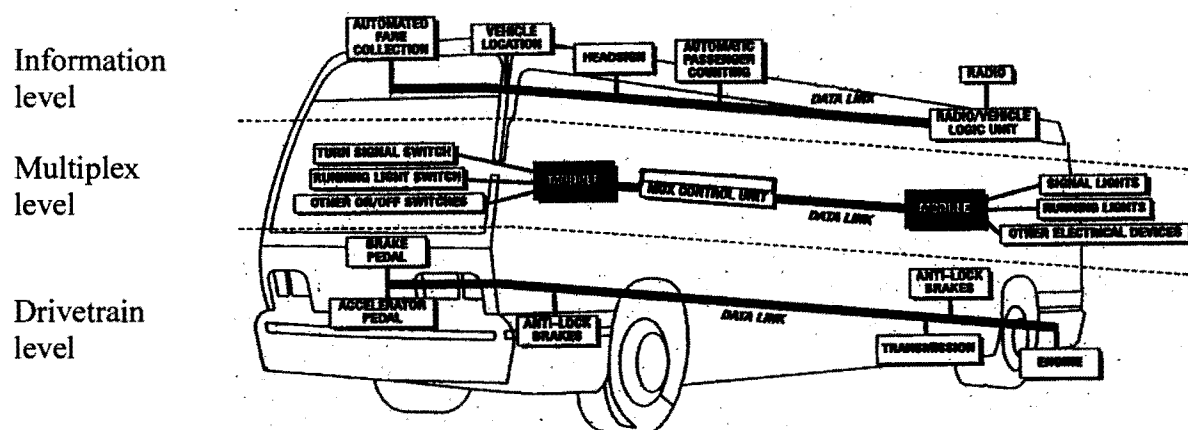
The data communication system consists of the bi-directional communications networks that electronic devices use to share data with other electronic devices and systems. Communication networks are essential to integrating electronic functions, both onboard the vehicle and off.

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

Data communications systems are divided into three levels to reflect the use of multiple data networks:

- **Drivetrain level:** Components related to the drivetrain including the propulsion system components (engine, transmission and hybrid units), and anti-lock braking system (ABS), which may include traction control.
- **Information level:** Components whose primary function is the collection, control or display of data that is not necessary to the safe drivability of the vehicle (i.e., the vehicle will continue to operate when those functions are inoperable). These components typically consist of those required for automatic vehicle location (AVL) systems, destination signs, fare boxes, passenger counters, radio systems, automated voice and signage systems, video surveillance and similar components.
- **Multiplex level:** Electrical or electronic devices controlled through input/output signals such as discrete, analog and serial data information (i.e., on/off switch inputs, relay or relay control outputs). Multiplexing is used to control components not typically found on the drivetrain or information levels, such as lights; wheelchair lifts; doors; heating, ventilation and air conditioning (HVAC) systems; and gateway devices.

**FIGURE 5**  
Data Communications Systems Levels



### TSE 38.1 Modular Design

Design of the electrical, electronic and data communication systems shall be modular so that each electronic device, apparatus panel, or wiring bundle is easily separable from its interconnect by means of connectors.

Powerplant wiring shall be an independent wiring harness. Replacement of the engine compartment wiring harness(es) shall not require pulling wires through any bulkhead or removing any terminals from the wires.

### TSE 39. Environmental and Mounting Requirements

The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed, as recommended in SAE J1455.

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

As a recommendation, no vehicle component shall generate, or be affected by, electromagnetic interference or radio frequency interference (EMI/RFI) that can disturb the performance of electrical/electronic equipment as defined in SAE J1113 and UNECE Council Directive 95/54 (R 10).

The City shall follow recommendations from bus manufacturers and subsystem Suppliers regarding methods to prevent damage from voltage spikes generated from welding, jump starts, shorts, etc.

#### **TSE 39.1 Hardware Mounting**

The mounting of the hardware shall not be used to provide the sole source ground, and all hardware shall be isolated from potential EMI/RFI, as referenced in SAE J1113.

All electrical/electronic hardware mounted in the interior of the vehicle shall be inaccessible to passengers and hidden from view unless intended to be viewed. The hardware shall be mounted in such a manner as to protect it from splash or spray.

All electrical/electronic hardware mounted on the exterior of the vehicle that is not designed to be installed in an exposed environment shall be mounted in a sealed enclosure.

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

#### ***TSE 40. General Electrical Requirements***

##### **TSE 40.1 Batteries**

###### **TSE 40.1.1. Low-Voltage Batteries (24V)**

###### **Four Group 31 Maintenance-Free Batteries**

Four Group 31 Series deep cycling maintenance-free battery units shall be provided. Each battery shall have a minimum of 730 to 750 cold cranking amps. Each battery shall have a purchase date no more than one year from the date of release for shipment to the City.

###### **Same Size Terminal Ends**

Positive and negative terminal ends shall be the same size.

###### **TSE 40.1.2 Battery Cables**

The battery terminal ends and cables shall be color-coded with red for the primary positive, black for negative and another color for any intermediate voltage cables. Positive and negative battery cables shall not cross each other if at all possible, be flexible and sufficiently long to reach the batteries with the tray in the extended position without stretching or pulling on any connection and shall not lie directly on top of the batteries. Except as interrupted by the master battery switch, battery and starter wiring shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE Standard J1127 – Type SGT, SGX or GXL and SAE Recommended Practice J541.

2100 strand 4/0 cable or greater recommended. Color code each voltage.

###### **TSE 40.1.3 Jump-Start**

Not required.

#### **TSE 40.1.4 Battery Compartment**

The battery compartment shall prevent accumulation of snow, ice and debris on top of the batteries and shall be vented and self-draining. It shall be accessible only from the outside of the vehicle. All components within the battery compartment, and the compartment itself, shall be protected from damage or corrosion from the electrolyte. The inside surface of the battery compartment's access door shall be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose.

The vehicle shall be equipped with a 12VDC and 24VDC quick disconnect switch(es). The battery compartment door shall conveniently accommodate operation of the 12VDC and 24VDC quick disconnect switch(es).

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

The battery hold-down bracket shall be constructed of a non-metallic material (plastic or fiberglass).

This access door shall not require any special locking devices to gain access to the switch, and it shall be accessible without removing or lifting the panel. The door shall be flush-fitting and incorporate a spring tensioner or equal to retain the door in a closed position when not in use.

The batteries shall be securely mounted on a stainless steel or equivalent tray that can accommodate the size and weight of the batteries. The battery tray shall pull out easily and properly support the batteries while they are being serviced. The tray shall allow each battery cell to be easily serviced and filled. A locking device shall retain the battery tray to the stowed position.

If not located in the engine compartment, the same fire-resistant properties must apply to the battery compartment. No sparking devices should be located within the battery box.

#### **TSE 40.1.5 Auxiliary Electronic Power Supply**

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

#### **TSE 40.1.6 Master Battery Switch**

A single master switch shall be provided near the battery compartment for the disconnecting of all battery positives (12V and 24V), except for safety devices such as the fire suppression system and other systems as specified. The location of the master battery switch shall be clearly identified on the exterior access panel, be accessible in less than 10 seconds for deactivation and prevent corrosion from fumes and battery acid when the batteries are washed off or are in normal service.



Turning the master switch off with the powerplant operating shall shut off the engine and shall not damage any component of the electrical system. The master switch shall be capable of carrying and interrupting the total circuit load.

#### **Single Switch**

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

#### **TSE 40.1.7 Low-Voltage Generation and Distribution**

The low-voltage generating system shall maintain the charge on fully charged batteries, except when the vehicle is at standard idle with a total low voltage generator load exceeding 70 percent of the low voltage generator nameplate rating.

Voltage monitoring and over-voltage output protection (recommended at 32V) shall be provided.

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

#### **TSE 40.1.8 Circuit Protection**

All branch circuits, except battery-to-starting motor and battery-to-generator/alternator circuits, shall be protected by current-limiting devices such as circuit breakers, fuses or solid state devices sized to the requirements of the circuit. Electronic circuit protection for the cranking motor shall be provided to prevent engaging of the motor for more than 30 seconds at a time to prevent overheating. The circuit breakers or fuses shall be easily accessible for authorized personnel. Fuses shall be used only where it can be demonstrated that circuit breakers are not practicable. This requirement applies to in-line fuses supplied by either the Contractor or a Supplier. Fuse holders shall be constructed to be rugged and waterproof. All manual reset circuit breakers critical to the operation of the bus shall be mounted in a location convenient to the City mechanic with visible indication of open circuits. The City shall consider the application of automatic reset circuit breakers on a case-by-case basis. The Contractor shall show all in-line fuses in the final harness drawings. Any manually resettable circuit breakers shall provide a visible indication of open circuits.

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

#### **TSE 40.2 Grounds**

The battery shall be grounded to the vehicle chassis/frame at one location only, as close to the batteries as possible. When using a chassis ground system, the chassis shall be grounded to the frame in multiple locations, evenly distributed throughout the vehicle to eliminate ground loops. No more than four ground ring/spade terminal connections shall be made per ground stud. Electronic equipment requiring an isolated ground to the battery (i.e., electronic ground) shall not be grounded through the chassis.



### **TSE 40.3 Low Voltage/Low Current Wiring and Terminals**

All power and ground wiring shall conform to specification requirements of SAE Recommended Practice J1127, J1128 and J1292. Double insulation shall be maintained as close to the junction box, electrical compartment or terminals as possible. The requirement for double insulation shall be met by wrapping the harness with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid or flexible conduit.

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

Strain-relief fittings shall be provided at all points where wiring enters electrical compartments. Grommets or other protective material shall be installed at points where wiring penetrates metal structures outside of electrical enclosures. Wiring supports shall be protective and non-conductive at areas of wire contact and shall not be damaged by heat, water, solvents or chafing.

To the extent practicable, wiring shall not be located in environmentally exposed locations under the vehicle. Wiring and electrical equipment necessarily located under the vehicle shall be insulated from water, heat, corrosion and mechanical damage. Where feasible, front to rear electrical harnesses should be installed above the window line of the vehicle.

All wiring harnesses over 5 ft long and containing at least five wires shall include 10 percent (minimum one wire) excess wires for spares. This requirement for spare wires does not apply to data links and communication cables. Wiring harness length shall allow end terminals to be replaced twice without pulling, stretching or replacing the wire. Terminals shall be crimped to the wiring according to the connector manufacturer's recommendations for techniques and tools. All cable connectors shall be locking type, keyed and sealed, unless enclosed in watertight cabinets or vehicle interior. Pins shall be removable, crimp contact type, of the correct size and rating for the wire being terminated. Unused pin positions shall be sealed with sealing plugs. Adjacent connectors shall either use different inserts or different insert orientations to prevent incorrect connections.

Terminals shall be crimped, corrosion-resistant and full ring type or interlocking lugs with insulating ferrules. When using pressure type screw terminal strips, only stranded wire shall be used. Insulation clearance shall ensure that wires have a minimum of "visible clearance" and a maximum of two times the conductor diameter or 1/16 in., whichever is less. When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands that can penetrate the insulation of the inner wires.

Ultra-sonic and T-splices may be used with 7 AWG or smaller wire. When a T-splice is used, it shall meet these additional requirements:

- It shall include a mechanical clamp in addition to solder on the splice.
- The wire shall support no mechanical load in the area of the splice.
- The wire shall be supported to prevent flexing.

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

Wiring located in the engine compartment shall be routed away from high-heat sources or shielded and/or insulated from temperatures exceeding the wiring and connector operating requirements.

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

#### **TSE 40.4 Electrical Components**

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

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

#### **TSE 40.5 Electrical Compartments**

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

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

#### ***TSE 40.6 High-Voltage Electrical System***

There shall be no exposed conductors, terminals, contacts or other energized parts with a high-voltage potential to any other exposed conductive material or person on the bus in normal operating charging configurations.

Non-conductive covers must prevent inadvertent human contact including service personnel working on or inside the vehicle. All HV (High Voltage) enclosures must be finger-proof (impossible to touch an HV terminal with a finger), tool-proof (impossible to touch an HV terminal with a tool (screwdriver, wrench, etc.), and drop-proof (small (e.g. #10) nut dropped on the enclosure cannot cause a short circuit, ground fault, or other hazardous condition). HV systems and containers must be protected from moisture.

The use of a key to unlock, or the removal of at least one threaded fastener shall be required to open covers or panels in order to gain access to high-voltage components. The access panels or covers limiting access to high-voltage components shall be clearly labeled as such. No single point failure of hardware, software, or of trained personnel to follow documented procedure shall result in an unreasonably safety risk to any person.

##### ***TSE 40.6.1. High Voltage Disconnect System***

The high-voltage system shall be fitted with automatic disconnecting contactors located as

closely as possible to the positive and negative battery output terminals so as to minimize the external circuitry that is not de-energized when the devices open. The contactors shall be capable of interrupting the maximum normal charging or operating current at the highest voltage likely to be encountered (maximum charger-output voltage, or charger-input voltage, whichever is greater). Contactors shall be controlled by the "High Voltage Disconnect" switch, and any safety-critical interlocks and interlock loops, motor-controller overcurrent protection functions, and vehicle crash and/or fire sensors. Reset of the contactors shall require the deliberate action of the operator or maintenance personnel. Contactors should provide a visual or electrical indication of their status (open or closed) or of a failure to function.

Lids to high voltage enclosures must be interlocked, such that opening an enclosure automatically disconnects the high voltage system. Any high voltage cable of 5 amps or greater must also have an interlock so that disconnecting any cable of this type will disconnect the high voltage system.

This feature could be part of the emergency shutdown system, providing an organized fail safe method for shutting the high voltage system down by manual activation of an emergency switch (red palm button).

#### ***TSE 40.6.2. High Voltage Wiring***

High-voltage wiring shall conform in all respects to SAE recommended practices J1654 (High-voltage Primary Cable), J1673 (High-Voltage Automotive Wiring), and J1742 (High Voltage On-board Connectors). The outer layer of insulation on high-voltage wiring shall be bright orange or yellow in color.

High-voltage wiring shall be protected from road hazards and collision damage by major structural members. Wiring shall be continuous cables with connections secured using suitable vibration resistant fasteners such as nylocks or lock washers on bolted terminals. Terminals shall be rated for the expected voltage and current, corrosion-resistant, and crimped or secured with setscrews.

Wiring length shall allow replacement of end terminals without pulling, stretching, or replacing the wire. Double insulation shall be maintained as close to the terminals as practicable. Terminal shanks and cable ends shall be protected by shrink tubing or vulcanized covers. Shrink tubing or vulcanized covers shall be the color coded to indicate polarity; black to indicate terminals normally negative, red for terminals normally positive. Red or black shall not be used for protective covers of terminals on wiring normally carrying high-voltage alternating currents. All high-voltage wiring shall be durably labeled and numbered to be identical from one bus to the next.

All HV wiring that runs through areas where rotating or moving components might cause abrasion must be enclosed in orange or yellow non-conductive conduit. The conduit must be securely anchored at least at each end, and must be located out of the way of possible snagging or damage. Wiring inside of battery enclosures is not required to be covered, but must be adequately secured and protected from abrasion and mechanical stress.

All external heat sinks or metal housings for HV components (i.e. motors, inverters, etc.) must be securely grounded. Within an enclosure, exposed (un-insulated) HV terminals and conductors of opposing polarities must be spaced with an adequate air gap to prevent arcing due to dielectric breakdown. It is strongly recommended that the spacing is significantly larger than this to reduce

the risk of accidental short circuit during service.

High-voltage wiring shall not be bundled with low-voltage wiring (except appropriately fused and distinctively marked high-voltage instrumentation-signal wires may be routed with other instrumentation-signal wires if the conduit or bundle is also distinctively marked as carrying high voltage). Grommets of elastomeric material shall be provided at points where wiring penetrates metal or rigid structures. Wiring supports shall be non-conductive. Precautions shall be taken to avoid damage from heat, water, solvents, commonly encountered automotive fluids, and chafing. Wire shall support no mechanical loads in the area of terminals and the wires shall be supported to prevent flexing. All wiring shall be numbered to be identical from one bus to the next.

***TSE 40.6.3. High Voltage Overcurrent Protection***

All wiring and connected devices and equipment shall be protected against overcurrent circuit breakers. Circuit breakers shall be rated to protect against prolonged overloads and short circuit conditions. The time-current characteristics of overcurrent protective devices and functions shall minimize hazard to personnel and equipment in the event of failure of any single protective device of function.

***TSE 40.6.4. High Voltage Grounding***

The bus chassis and all conductive structural elements of the vehicle shall be electrically interconnected by means of low-resistance mechanical connections, ground straps, wires, or welded connections. Buses with a nonconductive chassis shall be provided with a low-impedance grounding system suitably sized for the level and duration of possible faults currents. Ground paths shall not exhibit an electrical potential in excess of 0.1-volt relative to each other while the bus is off or in normal operating or charging configurations. The high-voltage electrical system shall not, in any normally encountered operational or charging configuration, make use of the vehicle chassis or of the low voltage grounding system as a current path. The high-voltage electrical system shall not, in any normally encountered operation or charging configuration, induce any detectable electrical current in the vehicle chassis, in the low-voltage grounding system, or in the low-voltage electrical systems except as a design feature of instrumentation circuits.

HV and low-voltage (chassis-grounded) circuits must be physically segregated. If both HV and grounded circuits are present within an enclosure, they must be separated by insulating barriers or other moisture resistant, UL recognized insulating materials, or well separated so that there is no risk of arcing due to dielectric breakdown or contact due to slight shifting of components during use.

If hazardous voltages are contained within a conductive exterior case or enclosed that may be exposed to human contact as installed in the vehicle, such case or enclosure shall be provided with a conductive connection to the vehicle chassis or grounding system.

Energy storage components (including batteries) and major power electronics components shall have their conductive external cases connected to the vehicle chassis or grounding system by a ground strap, wire, welded connection or other suitable low resistance mechanical connection. This grounding connection shall provide a low impedance path, sized appropriately for the level and duration of possible fault currents. Ground paths shall not be carried through hinges, bolted joints (except those specifically designed as electrical connectors), body or power plant mountings.



Other components that receive hazardous voltages from sources outside their enclosures may have their cases grounded either directly (as above) or indirectly through the wiring harness that carries the voltage(s) from the external source. Disconnecting the wiring harness used to provide indirect case grounding shall also disconnect the source of hazardous voltages. Loss of isolation of the high-voltage electrical system from the chassis grounding system shall cause a dashboard-warming lamp to illuminate and automatic disconnect of the high-voltage system.

***TSE 40.6.5. DC-DC Converters and DC-AC Inverters***

The buses shall be fitted with a device or controller function to maintain the low-voltage batteries at a full state-of-charge using energy drawn from the traction battery.

The high-voltage inputs to individual DC-to-AC and DC-to-DC conversion devices shall be protected by circuit breakers. The output circuits of DC-to-AC and DC-to-DC conversion devices shall also be protected by appropriately rated circuit breakers.

Verification of the working of charger function will be done throughout the acceptance testing. Verification that the circuit breakers are appropriately sized will be done by consulting the conversion devices maker's literature in the Offerors engineering files.

***TSE 41. General Electronic Requirements***

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

All electronic component Suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and also in over-voltage (over 32V DC on a 24V DC nominal voltage rating with a maximum of 50V DC) and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors. Where this is not possible, the use of a pull-up or pull-down resistor shall be limited as much as possible and easily accessible and labeled.

***TSE 41.1 Wiring and Terminals***

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

***TSE 41.1.1 Discrete I/O (Inputs/Outputs)***

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

***TSE 41.1.2 Shielding***

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



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

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

#### **TSE 41.1.3 Communications**

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

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

#### **TSE 41.1.4 Radio Frequency (RF)**

RF components, such as radios, video devices, cameras, global positioning systems (GPS), etc., shall use coaxial cable to carry the signal. All RF systems require special design consideration for losses along the cable. Connectors shall be minimized, since each connector and crimp has a loss that will attribute to attenuation of the signal. Cabling should allow for the removal of antennas or attached electronics without removing the installed cable between them. If this cannot be done, then a conduit of sufficient size shall be provided for ease of attachment of antenna and cable assembly. The corresponding component vendors shall be consulted for proper application of equipment, including installation of cables.

#### **TSE 41.1.5 Audio**

Cabling used for microphone level and line level signals shall be 22 AWG minimum with shielded twisted pair. Cabling used for amplifier level signals shall be 18 AWG minimum.

### ***TSE 42. Multiplexing***

#### **TSE 42.1 General**

The primary purpose of the multiplexing system is control of components necessary to operate the vehicle. This is accomplished by processing information from input devices and controlling output devices through the use of an internal logic program.

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

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

## **TSE 42.2 System Configuration**

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

### **TSE 42.2.1 I/O Signals**

The input/output for the multiplex system may contain three types of electrical signals: discrete, analog or serial data.

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

## ***TSE 43. Data Communications***

### **TSE 43.1 General**

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

- Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking and transport (bulk transfer of data to/from the device).
- Data definition requirements that ensure access to diagnostic information and performance characteristics.
- The capability and procedures for uploading new application or configuration data.
- Access to revision levels of data, application software and firmware.
- The capability and procedures for uploading new firmware or application software.
- Evidence that applicable data shall be broadcast to the network in an efficient manner such that the overall network integrity is not compromised.

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

### **TSE 43.2 Drivetrain Level**

Drivetrain components, consisting of the engine, transmission, retarder, anti-lock braking system and all other related components, shall be integrated and communicate fully with respect to vehicle operation with data using SAE Recommended Communications Protocols such as J1939 with forward and backward compatibilities or other open protocols.

#### **TSE 43.2.1 Diagnostics, Fault Detection and Data Access**

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

The drivetrain level shall have the ability to record abnormal events in memory and provide diagnostic codes and other information to service personnel. At a minimum, this network

level shall provide live/fail status, current hardware serial number, software/data revisions and uninterrupted timing functions.

#### **TSE 43.2.2 Programmability (Software)**

The drivetrain level components shall be programmable by the City with limitations as specified by the sub-system Supplier.

### **TSE 43.3 Multiplex Level**

#### **TSE 43.3.1 Data Access**

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

#### **TSE 43.3.2 Diagnostics and Fault Detection**

The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (online) or inactive (offline) faults through the use of on-board visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or a handheld unit. Either unit shall have the ability to check logic function. The diagnostic data can be incorporated into the information level network or the central data access system.

No requirement for mock-up board.

#### **TSE 43.3.3 Programmability (Software)**

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

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

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

- hardware component identification where labels are included on all multiplex hardware to identify components
- hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module
- software revision identification where all copies of the software in service displays the most recent revision number
- a method of determining which version of the software is currently in use in the multiplex system

Revision control labels shall be electronic.

#### **TSE 43.4 Electronic Noise Control**

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

Electrical and electronic sub-systems on the coaches shall not be affected by external sources of RFI/EMI. This includes, but is not limited to, radio and TV transmission, portable electronic devices including computers in the vicinity of or onboard the buses, ac or dc power lines and RFI/EMI emissions from other vehicles.

### **DRIVER PROVISIONS, CONTROLS AND INSTRUMENTATION**

#### ***TSE 44. Driver's Area Controls***

##### **TSE 44.1 General**

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

Switches and controls shall be divided into basic groups and assigned to specific areas, in conformance with SAE Recommended Practice J680, Revised 1988, "Location and Operation of Instruments and Controls in Motor Truck Cabs," and be essentially within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach."

##### **TSE 44.2 Glare**

The driver's work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black or dark gray in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the driver's area shall be avoided.

##### **TSE 44.3 Visors/Sun Shades**

###### **Front and Side Sun Shade/Visor**

Adjustable sun visor(s) shall be provided for the driver's windshield and the driver's side window. Visors shall be shaped to minimize light leakage between the visor and windshield pillars. Visors shall store out of the way and shall not obstruct airflow from the climate control system or interfere with other equipment, such as the radio handset or the destination control. Deployment of the visors shall not restrict vision of the rearview mirrors. Visor adjustments shall be 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 may be transparent, but shall not allow a visible light transmittance in excess of 10 percent. Visors, when deployed, shall be effective in the driver's field of view at angles more than 5 degrees above the horizontal.

##### **TSE 44.4 Driver's Controls**

Frequently used controls must be in easily accessible locations. These include the door control, kneel control, windshield wiper/washer controls, ramp, and lift and run switch. Any switches and controls necessary for the safe operation of the bus shall be conveniently located and shall provide for ease of operation. They shall be identifiable by shape, touch and permanent markings. Controls also shall be located so that passengers may not easily tamper with control settings.

All panel-mounted switches and controls shall be marked with easily read identifiers. Graphic symbols shall conform to SAE Recommended Practice J2402, "Road Vehicles – Symbols For Controls, Indicators, and Tell Tales," where available and applicable. Color of switches and controls shall be dark with contrasting typography or symbols.

Mechanical switches and controls shall be replaceable, and the wiring at these controls shall be serviceable from a convenient location. Switches, controls and instruments shall be dust- and water-resistant.

#### **TSE 44.5 Normal Bus Operation Instrumentation and Controls**

The following list identifies bus controls used to operate the bus. These controls are either frequently used or critical to the operation of the bus. They shall be located within easy reach of the operator. The operator shall not be required to stand or turn to view or actuate these controls unless specified otherwise.

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

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

On-board displays visible to the operator shall be limited to indicating the status of those functions described herein that are necessary for the operation of the bus. All other indicators needed for diagnostics and their related interface hardware shall be concealed and protected from unauthorized access. Table 3 represents instruments and alarms. The intent of the overall physical layout of the indicators shall be in a logical grouping of systems and severity nature of the fault.

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

**TABLE 6**  
Transit Bus Instruments and Alarms

<b>Device</b>	<b>Description</b>	<b>Location</b>	<b>Function</b>	<b>Visual/ Audible</b>
Master run switch	Rotary, four- position detent	Side console	Master control for bus, off, day run, night run and clearance ID lights	
Engine start, front	Approved momentary switch	Side console	Activates engine starter motor	
Engine start, rear	Approved momentary switch	Engine compartment	Activates engine starter motor	



**TABLE 6**  
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
Engine run, rear	Three-position toggle switch	Engine compartment	Permits running engine from rear start, normal front run position and off	Amber light
Drive selector	Touch panel switch	Side console	Provides selection of propulsion: forward, reverse and neutral	Gear selection
HVAC	Switch or switches to control HVAC	Side console	Permits selection of passenger ventilation: off, cool, heat, low fan, high fan or full auto with on/off only	
Driver's ventilation	Rotary, three-position detent	Side console or Dash left wing	Permits supplemental ventilation: fan off, low or high	
Defroster fan	Rotary, three-position detent	Side console or Dash left wing	Permits defroster: fan off, low, medium or high	
Defroster temperature	Variable position	Side console or Dash left wing	Adjusts defroster water flow and temperature	
Windshield wiper	One-variable rotary position operating both wipers	Dash left wing	Variable speed control of left and right windshield wipers	
Windshield washer	Push button	Dash left wing	Activates windshield washers	
Dash panel lights	Rotary rheostat or stepping switch	Side Console or Dash left wing	Provides adjustment for light intensity in night run position	
Interior lights	Three-position switch	Side console	Selects mode of passenger compartment lighting: off, on, normal	
Fast idle	Two-position switch	Side console	Selects high idle speed of engine	
WC ramp/kneel enable	Two-position switch <sup>1</sup>	Side console or Dash right wing	Permits operation of ramp and kneel operations at each door remote panel	Amber light
Curb-side Front door ramp/kneel enable	Two-position keyed switch <sup>1</sup>	Front door remote or Dash right wing	Permits ramp and kneel activation from front door area, key required <sup>1</sup>	Amber light

**TABLE 6**  
Transit Bus Instruments and Alarms

<b>Device</b>	<b>Description</b>	<b>Location</b>	<b>Function</b>	<b>Visual/ Audible</b>
Curb-side Front door ramp	Three-position momentary switch	Right side of steering wheel	Permits deploy and stow of front ramp	Red light
Front kneel	Three-position momentary switch	Front door remote	Permits kneeling activation and raise and normal at front door remote location	Amber or red dash indicator. Ext alarm and Amber light
Curb-side Center, Rear door ramp/kneel enable	Three-position momentary switch	Right side of steering wheel	Permits Bridge Plate activation from driver's seat	Red light
Street-side Front, Rear door ramp/kneel enable	Three-position momentary switch	Right side of steering wheel	Permits Bridge Plate activation from driver's seat	Red light
Rear door ramp	Three-position momentary switch	Rear door remote	Permits deploy and stow of rear ramp	
Rear kneel	Three-position momentary switch	Rear door remote	Permits kneeling activation and raise and normal at rear door remote location	
Stop Requested	Indication a stop is requested	In approved location	Notifies driver with visual cue when a passenger is requesting a stop.	Blue light
Silent alarm	Toggle switch with cover	Side console	Activates emergency radio alarm at dispatch and permits covert microphone.	
Left remote mirror	Four-position toggle type	Side console	Permits two-axis adjustment of left exterior mirror	
Right remote mirror	Four-position toggle type	Side console	Permits two-axis adjustment of right exterior mirror	
Mirror heater	Switch or temperature activated	Side console	Permits heating of outside mirrors when required	
Street side Passenger door control	Front, Center and Rear push button type control	Side console, forward	Permits open/close control of front and rear passenger doors	Red light

**TABLE 6**  
Transit Bus Instruments and Alarms

<b>Device</b>	<b>Description</b>	<b>Location</b>	<b>Function</b>	<b>Visual/ Audible</b>
Curb side Passenger door control	Front, Center and Rear push button type control	Side console, forward	Permits open/close control of front, center and rear passenger doors	Red light
Curb side Center & Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
Street side Center & Rear door override	Two-position switch in approved location	Side console, forward	Allows driver to override activation of rear door passenger tape switches	
Engine shutdown override	Momentary switch with operation protection	Side console	Permits driver to override auto engine shutdown	
Hazard flashers	Two-position switch	Side console or Dash right wing	Activates emergency flashers	Two green lights
Automated Announcement System Logon Device	Automated Announcement System Logon Device	Just above left hand dash accessible to seated driver	Facilitates driver interaction with automated ADA announcement system logon and automatically controls destination signs.	LCD display with visual status and text messages
Farebox interface	Farebox coach operator interface panel	In approved location	Facilitates driver interaction with farebox system, identifies the route.	LCD display
Destination sign interface	Destination sign interface panel	in approved location	Facilitates driver interaction with destination sign system, identifies Route for sign & ADA announcements.	LCD display
Turn signals	Momentary push button (two required) raised from other switches	Left foot panel	Activates left and right turn signals	Two green lights and audible indicator
PA manual	Momentary push button	In approved location	Permits driver to manually activate public address microphone	
Low profile microphone	Low-profile discrete Mounting	Steering column	Permits driver to make announcements with both hands on the wheel and focusing on road conditions	

**TABLE 6**  
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
High beam	Detented push button	In approved location	Permits driver to toggle between low and high beam	Blue light
Parking brake	Pneumatic PPV	Side console or Dash left wing	Permits driver to apply and release parking brake	Red light
Park brake release	Pneumatic PPV	Vertical side of the side console or dash center	Permits driver to push and hold to release brakes	
Hill holder	Two-position momentary switch	Side console	Applies brakes to prevent bus from rolling	
Remote engine speed	Rotary rheostat	Engine compartment	Permits technician to raise and lower engine RPM from engine compartment	
Master door/interlock	Multi-pole toggle, detented	Out of operator's reach	Permits driver override to disable door and brake/throttle interlock	Red light
Warning interlocks deactivated	Red indicator light	Dash panel center	Illuminates to warn drive that interlocks have been deactivated.	Red light
Retarder disable	Multi-pole switch detented	Within reach of Operator or approved location	Permits driver override to disable brake retardation/regeneration	Red light
Curb-side Center and Rear doors passenger sensor disable	Multi-pole toggle, detented	In sign compartment or Driver's barrier compartment	Permits driver to override rear door passenger sensing system	
Street-side Front and Rear doors passenger sensor disable	Multi-pole toggle, detented	In sign compartment or Driver's barrier compartment	Permits driver to override rear door passenger sensing system	
Indicator/ alarm test button	Momentary switch or programming <sup>1</sup>	Dash center panel	Permits driver to activate test of sentry, indicators and audible alarms	All visuals and audibles
Auxiliary power	110-volt power receptacle	Approved location	Property to specify what function to supply	N/A

**TABLE 6**  
Transit Bus Instruments and Alarms

<b>Device</b>	<b>Description</b>	<b>Location</b>	<b>Function</b>	<b>Visual/ Audible</b>
Speedometer	Speedometer, odometer, and diagnostic capability, 5-mile increments	Dash center panel	Visual indication of speed and distance traveled, accumulated vehicle mileage, fault condition display	Visual
Air pressure gauge	Primary and secondary, 5 psi increments	Dash center panel	Visual indication of primary and secondary air systems	Red light and buzzer
Fire detection	Coach operator display	dash center	Indication of fire detection activation location	Buzzer and red light
Curb-side Door obstruction	Sensing of door obstruction	Dash center	Indication of center or rear doors sensitive edge activation	Red light and buzzer
Curb-side Door ajar	Door not properly closed	Property specific or dash center	Indication of center or rear doors not properly closed	Buzzer or alarm and red light
Street-side Door obstruction	Sensing of door obstruction	Dash center	Indication of Front or rear doors sensitive edge activation	Red light and buzzer
Street-side Door ajar	Door not properly closed	Property specific or dash center	Indication of Front or rear doors not properly closed	Buzzer or alarm and red light
Low system air pressure	Sensing low primary and secondary air tank pressure	Dash center	Indication of low air system pressure	Buzzer and red light
Engine coolant indicator	Low coolant indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low coolant condition	Amber light
Hot engine indicator	Coolant temperature indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects hot engine condition and initiates time delay shutdown	Red light



**TABLE 6**  
Transit Bus Instruments and Alarms

Device	Description	Location	Function	Visual/ Audible
Low engine oil pressure indicator	Engine oil pressure indicator may be supplied as audible alert and visual and/or text message	Within driver's sight	Detects low engine oil pressure condition and initiates time-delayed shutdown	Red light
ABS indicator	Detects system status	Dash center	Displays system failure	Amber light
HVAC indicator	Detects system status	Dash center	Displays system failure	Amber or red light
Charging system indicator (12/24 V)	Detect charging system status	Dash center	Detects no charge condition and optionally detects battery high, low, imbalance, no charge condition, and initiates time-delayed shutdown	Red light flashing or solid based on condition
Fuel tank level	Analog gauge, graduated based on fuel type	Dash center	Indication of fuel tank level/pressure	
DEF gauge	Level Indicator	Center dash	Displays level of DEF tank and indicates with warning light when low	N/A
Turntable	Detects Status	Dash Center	Warning indication for hinge locking	Audible and amber warning and red light if locked
Turntable	Interlock momentary switch	Side console	Momentarily release interlock brakes due to over angled condition	

#### **TSE 44.6 Driver Foot Controls**

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

##### **TSE 44.6.1 Pedal Angle**

The vertical angle of the accelerator and brake pedals shall be determined from a horizontal plane regardless of the slope of the cab floor. The accelerator and brake pedals shall be positioned at an angle of 37 to 50 degrees at the point of initiation of contact and extend downward to an angle of 10 to 18 degrees at full throttle.

The location of the brake and accelerator pedals shall be determined by the manufacturer, based on space needs, visibility, lower edge of windshield, and vertical H-point.

#### **TSE 44.6.2 Pedal Dimensions and Position**

The floor-mounted accelerator pedal shall be 10 to 12 in. long and 3 to 4 in. wide. Clearance around the pedal must allow for no interference precluding operation.

#### **1 to 2 in. Between Brake and Accelerator Pedals**

The accelerator and brake pedals shall be positioned such that the spacing between them, measured at the heel of the pedals, is between 1 and 2 in. Both pedals should be located approximately on the same plane coincident to the surface of the pedals.

#### **TSE 44.7 Brake and Accelerator Pedals**

##### **Brake Pedal**

Non-adjustable brake pedal.

#### **TSE 44.8 Driver Foot Switches**

##### **Floor-Mounted Foot Control Platform**

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

##### **Turn Signal Controls**

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

##### **Foot Switch Control**

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

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

##### **Other Floor-Mounted Controls**

- silent alarm
- PA system

Steering wheel mounted (self-canceling)

#### ***TSE 45. Driver's Amenities***

##### **TSE 45.1 Coat Hanger**

N/A

#### **TSE 45.2 Drink Holder**

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

#### **TSE 45.3 Storage Box**

An enclosed driver storage area shall be provided with a positive latching door and thumb lock. The minimum size is 2750 cubic in.

### ***TSE 46. Windshield Wipers and Washers***

#### **TSE 46.1 Windshield Wipers**

The bus shall be equipped with a windshield wiper for each half of the windshield. At 60 mph, no more than 10 percent of the wiped area shall be lost due to windshield wiper lift. For two-piece windshields, both wipers shall park along the center edges of the windshield glass. For single-piece windshields, wipers shall park along the bottom edge of the windshield. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service. The fastener that secures the wiper arm to the drive mechanism shall be corrosion-resistant.

#### **Wiper Powered by Compressed Air**

If powered by air, exhaust from the wiper motors shall be muffled or piped under the floor of the bus.

Dual controls for air-operated system.

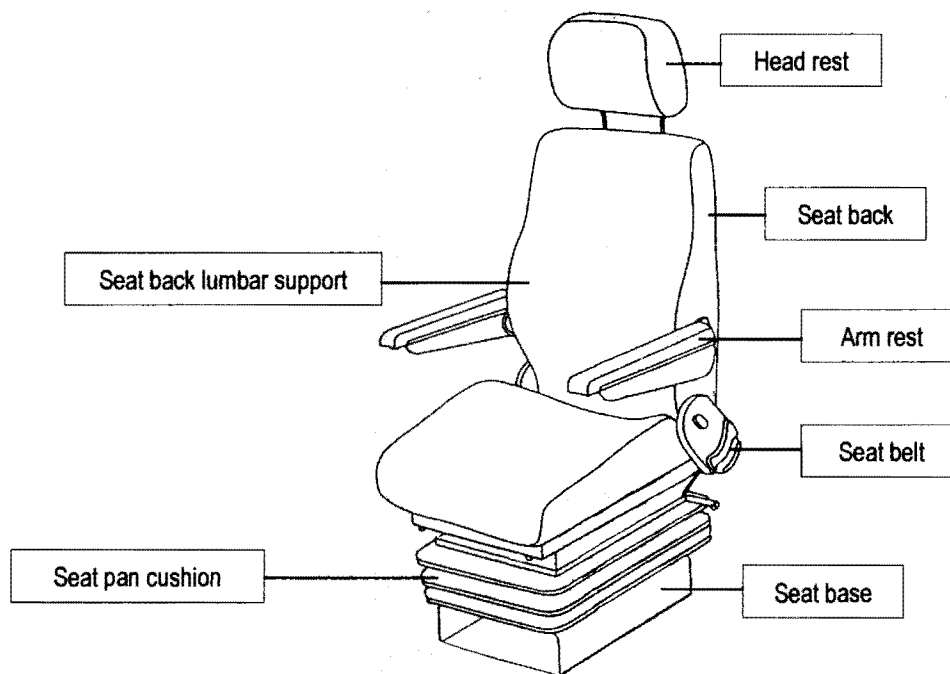
#### **Intermittent Wiper with Variable Control**

A variable-speed feature shall be provided to allow adjustment of wiper speed for each side of the windshield between approximately five (5) and twenty-five (25) cycles per minute.

#### **TSE 46.2 Windshield Washers**

The windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area.

The windshield washer system shall have a minimum 3-gallon reservoir, located for easy refilling from outside of the bus. Reservoir pumps, lines and fittings shall be corrosion-resistant and must include a means to determine fluid level.

**TSE 47. Driver's Seat****FIGURE 6****Driver's Seat****TSE 47.1 Dimensions**

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

**TSE 47.1.1 Seat Pan Cushion Length**

Measurement shall be from the front edge of the seat pan to the rear at its intersection with the seat back. The adjustment of the seat pan length shall be no less than 16.5 in. at its minimum length and no more than 20.5 in. at its maximum length.

**TSE 47.1.2 Seat Pan Cushion Height**

Measurement shall be from the cab floor to the top of the level seat at its center midpoint. The seat shall adjust in height from a minimum of 14 in., with a minimum 6 in. vertical range of adjustment.

**TSE 47.1.3 Seat Pan Cushion Slope**

Measurement is the slope of the plane created by connecting the two high points of the seat, one at the rear of the seat at its intersection with the seat back and the other at the front of the seat just before it waterfalls downward at the edge. The slope can be measured using an inclinometer and shall be stated in degrees of incline relative to the horizontal plane (0 degrees). The seat pan shall adjust in its slope from no less than plus 12 degrees (rearward "bucket seat" incline), to no less than minus 5 degrees (forward slope).

**TSE 47.1.4 Seat Base Fore/Aft Adjustment**

Measurement is the horizontal distance from the heel point to the front edge of the seat. The minimum and maximum distances shall be measured from the front edge of the seat when it

is adjusted to its minimum seat pan depth (approximately 15 in.). On all low-floor buses, the seat-base shall travel horizontally a minimum of 9 in. It shall adjust no closer to the heel point than 6 in. On all high-floor buses, the seat base shall travel a minimum of 9 in. and adjust no closer to the heel-point than 6 in.

#### **TSE 47.1.5 Seat Pan Cushion Width**

Measurement is the horizontal distance across the seat cushion. The seat pan cushion shall be 17 to 21 in. across at the front edge of the seat cushion and 20 to 23 in. across at the side bolsters.

#### **TSE 47.1.6 Seat Suspension**

The driver's seat shall be appropriately dampened to support a minimum weight of 380 lbs. The suspension shall be capable of dampening adjustment in both directions.

Rubber snubbers shall be provided to prevent metal-to-metal contact.

#### **TSE 47.1.7 Seat Back**

##### **Width**

Measurement is the distance between the outermost points of the front of the seat back, at or near its midpoint in height. The seat back width shall be no less than 19 in. Seat back will include dual recliner gears on both sides of the seat.

##### **Height**

Standard height seat back.

#### **TSE 47.1.8 Headrests**

Adjustable headrest.

#### **TSE 47.1.9 Seat Back Lumbar Support**

Measurement is from the bottom of the seat back at its intersection with the seat pan to the top of the lumbar cushioning. The seat back shall provide adjustable depth lumbar back support with three individual operating lumbar cells within a minimum range of 7 to 11 in.

#### **TSE 47.1.10 Seat Back Angle Adjustment**

The seat back angle shall be measured relative to a level seat pan, where 90 degrees is the upright position and 90 degrees-plus represents the amount of recline.

The seat back shall adjust in angle from a minimum of no more than 90 degrees (upright) to at least 105 degrees (reclined), with infinite adjustment in between.

#### **TSE 47.2 Seat Belt**

The belt assembly should be an auto-locking retractor (ALR). All seat belts should be stored in automatic retractors. The belts shall be mounted to the seat frame so that the driver may adjust the seat without resetting the seat belt.

The seat and seat belt assemblies as installed in the bus shall withstand static horizontal forces as required in FMVSS 207 and 210.



**Lap and Shoulder (Three-Point) Seat Belt**

Seat belts shall be provided across the driver's lap and diagonally across the driver's chest. The driver shall be able to use both belts by connecting a single buckle on the right side of the seat cushion. 3-pt seatbelts must be emergency locking retractor (ELR) in design.

**Lap Belt Length**

**72 in. with Extension**

The lap belt assembly shall be 72 in. in length with an 8-in. extension

**TSE 47.3 Adjustable Armrest**

There should be no armrests.

**TSE 47.4 Seat Control Locations**

While seated, the driver shall be able to make seat adjustments by hand without complexity, excessive effort or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes.

**TSE 47.5 Seat Structure and Materials**

Cushions shall be fully padded with at least 3 in. of materials in the seating areas at the bottom and back.

**Cushion Materials**

Black vinyl. Closed-cell polyurethane (FMVSS 302).

**TSE 47.6 Pedestal**

Stainless steel.

**TSE 47.7 Seat Options**

USSC 9100 ALX/3PT or approved equal.

**TSE 47.8 Mirrors**

**TSE 47.8.1 Exterior Mirrors**

The bus shall be equipped with a corrosion-resistant, outside rearview mirrors mounted with stable supports to minimize vibration. Mirrors shall be firmly attached to the bus to minimize vibration and to prevent loss of adjustment with a breakaway mounting system. Mirrors shall permit the driver to view the roadway along the sides of the bus, including the rear wheels. Mirrors should be positioned to prevent blind spots.

Mirrors shall retract or fold sufficiently to allow bus washing operations but avoid contact with windshield.

Spring loaded mirror heads auto return.

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

Exterior mirrors shall contain LED turn signal indicators.

### **Curbside Mirrors**

The curbside rearview mirror shall be mounted so that its lower edge is no less than 76 in. above the street surface. A lower mount may be required due to requested mirror configuration requests

### **Remote Adjustment of Curbside Mirror**

The driver shall be able to adjust the curbside mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

### **Street-Side Mirrors**

### **Remote Adjustment of Curbside Mirror**

The driver shall be able to adjust the street-side mirror remotely while seated in the driving position. The control for remote positioning of the mirror shall be a single switch or device.

### **TSE 47.8.2 Interior Mirrors**

Mirrors shall be provided for the driver to observe passengers throughout the bus without leaving the seat and without shoulder movement. The driver shall be able to observe passengers in the front/entrance and rear/exit areas, anywhere in the aisle, and in the rear seats.

## **WINDOWS**

### ***TSE 48. General***

A minimum of 10,000 sq. in. of window area, including operator and door windows, shall be required on each side of the standard configuration bus.

### ***TSE 49. Windshield***

The windshield shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of 14 degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object 3½ ft. high no more than 2 ft. in front of the bus. The horizontal view shall be a minimum of 90 degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the 90-degree requirement, provided that the divider does not exceed a 3-degree angle in the operator's field of view. Windshield pillars shall not exceed 10 degrees of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshields shall not be used. Winglets may be bonded.

### **TSE 49.1 Glazing**

The windshield glazing material shall have a ¼ in. nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673. Lace-seal

### **Shaded Band**

The upper portion of the windshield above the driver's field of view shall have a dark, shaded band with a minimum luminous transmittance of 5 percent when tested in accordance to ASTM D-1003.

***TSE 50. Driver's Side Window***

The driver's side window shall be the sliding type, requiring only the rear half of sash to latch upon closing, and shall open sufficiently to permit the seated operator to easily adjust the street-side outside rearview mirror. When in an open position, the window shall not rattle or close during braking. This window section shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall have a single-density tint.

The driver's view, perpendicular through operator's side window glazing, should extend a minimum of 33 in. (840 mm) to the rear of the heel point on the accelerator, and in any case must accommodate a 95th percentile male operator. The view through the glazing at the front of the assembly should begin not more than 26 in. (560 mm) above the operator's floor to ensure visibility of an under-mounted convex mirror. Driver's window construction shall maximize ability for full opening of the window.

The driver window glazing material shall be ThermoGuard Blue Spruce 70. The glazing shall be 6 mm laminated heat-treated safety. The material shall conform to the requirements of ANSI Z26.1 and the Recommended Practices defined in SAJ673. The glass tint shall be blue with 70% LT or greater and comply with AS2 DOT requirements, blocking 99% of the UV and allowing less than 3–6% of the infrared heat to pass through the pane.

**Hidden Frame (Flush "Euro-look") Driver's Side Window**

- full slider
- non-egress

***TSE 51. Side Windows*****TSE 51.1 Configuration**

Side windows shall not be bonded in place, but shall be easily replaceable without disturbing adjacent windows and shall be mounted so that flexing or vibration from engine operation or normal road excitation is not apparent. All aluminum and steel material will be treated to prevent corrosion.

**TSE 51.2 Emergency Exit (Egress) Configuration****Minimum Egress**

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

**Standard Passenger Side Window Configurations**

- hidden frame (flush "Euro-look")
  - full fixed

**Hidden Frame (Seamless)**

- full fixed

**TSE 51.3 Configuration****Fixed Side Windows**

All side windows shall be fixed in position, except as necessary to meet the emergency escape requirements.

#### **TSE 51.4 Materials**

##### **Safety Glass Glazing Panels**

The side window glazing material shall be ThermoGuard Blue Spruce 70. The glazing shall be 6 mm laminated heat-treated safety glass. The material shall conform to the requirements of ANSI Z26.1 and the Recommended Practices defined in SAJ673. The glass tint shall be blue with 70% LT or greater and comply with AS2 DOT requirements, blocking 99% of the UV and allowing less than 3–6% of the infrared heat to pass through the pane.

##### **Graffiti Shield Coating**

The interior side windows of each bus shall be delivered with 3M™ 4- Layer Graffiti Film affixed to each window.

#### **TSE 51.5 Rear Window**

No requirement for rear window.

### **HEATING, VENTILATING AND AIR CONDITIONING**

#### ***TSE 52. Capacity and Performance***

The HVAC climate control system shall be capable of controlling the temperature and maintaining the humidity levels of the interior of the bus as defined in the following paragraphs.

##### **Allow Rear-Mounted HVAC Unit**

The HVAC unit will be rear-mounted Thermo King.

Fully AC high-voltage electric-driven A/C system with full hermetic AC compressor, condenser fan, evaporator blower motors and brushless AC generators.

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

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

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

System capacity testing, including pull-down/warm-up, stabilization and profile, shall be conducted in accordance to the APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System."

The recommended locations of temperature probes are only guidelines and may require slight modifications to address actual bus design. Care must be taken to avoid placement of sensing devices in the immediate path of an air duct outlet. In general, the locations are intended to accurately represent the interior passenger area.

Additional testing shall be performed as necessary to ensure compliance to performance requirements stated herein.

### **Capacity and Performance Requirements**

The air-conditioning portion of the HVAC system shall be capable of reducing the passenger compartment temperature from 110 to 90 °F in less than 20 minutes after engine start-up. Engine temperature shall be within the normal operating range at the time of start-up of the cool-down test, and the engine speed shall be limited to fast idle, which may be activated by a driver-controlled device. During the cool-down period, the refrigerant pressure shall not exceed safe high-side pressures, and the condenser discharge air temperature, measured 6 in. from the surface of the coil, shall be less than 45 °F above the condenser inlet air temperature. The appropriate solar load as recommended in the APTA "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System," representing 4 p.m. on August 21, shall be used. There shall be no passengers on board, and the doors and windows shall be closed.

### **R407C**

The air conditioning system shall meet these performance requirements using R407C.

### ***TSE 53. Controls and Temperature Uniformity***

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

### **Fully Automatic Climate Control System**

The climate control system shall be fully automatic and control the interior average temperature to within  $\pm 2$  °F of specified temperature control set-point.

### **Single Control Set Point at 70 °F**

The temperature control set-point for the system shall be 70 °F.

Interior temperature distribution shall be uniform to the extent practicable to prevent hot and/or cold spots. After stabilization with doors closed, the temperatures between any two points in the passenger compartment in the same vertical plane, and 6 to 72 in. above the floor, shall not vary by more than 5 °F with doors closed. The interior temperatures, measured at the same height above the floor, shall not vary more than  $\pm 5$  °F from the front to the rear from the average temperature determined in accordance with APTA's "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." Variations of greater than  $\pm 5$  °F will be allowed for limited, localized areas provided the majority of the measured temperatures fall within the specified requirement.

### ***TSE 54. Air Flow***

#### **TSE 54.1 Passenger Area**

The cooling mode of the interior climate control system shall introduce air into the bus at or near the ceiling height at a minimum rate of 25 cubic ft per minute (cfm) per passenger based on the standard configuration bus carrying a number of passengers equal to 150 percent of the seated load. Airflow shall be evenly distributed throughout the bus, with air velocity not exceeding 100 ft per minute on any passenger. The ventilating mode shall provide air at a minimum flow rate of 20 cfm per passenger.

Airflow may be reduced to 15 cfm per passenger (150 percent of seated load) when operating in the heating mode. The fans shall not activate until the heating element has warmed sufficiently to ensure



at least 70 °F air outlet temperature. The heating air outlet temperature shall not exceed 120 °F under any normal operating conditions.

The climate control blower motors and fan shall be designed such that their operation complies with the interior noise level requirements.

### **No "Fresh Air" Requirements**

#### **TSE 54.2 Driver's Area**

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

#### **TSE 54.3 Controls for the Climate Control System (CCS)**

The controls for the driver's compartment for heating, ventilation and cooling systems shall be integrated and shall meet the following requirements:

- The heat/defrost system fan shall be controlled by a separate switch that has an "off" position and at least two positions for speed control. All switches and controls shall preclude the possibility of clothing becoming entangled, and shields shall be provided, if required. If the fans are approved by the City, an "on-off" switch shall be located to the right of or near the main defroster switch.
- A manually operated control valve shall control the coolant flow through the heater core.
- If a cable-operated manual control valve is used, the cable length shall be kept to a minimum to reduce cable seizing. Heater water control valves shall be "positive" type, closed or open. The method of operating remote valves shall require the concurrence of the City project manager.

#### **TSE 54.4 Driver's Compartment Requirements**

A separate heating, ventilation and defroster system for the driver's area shall be provided and shall be controlled by the driver. The system shall meet the following requirements:

- The heater and defroster system shall provide heating for the driver and heated air to completely defrost and defog the windshield, driver's side window, and the front door glasses in all operating conditions. Fan(s) shall be able to draw air from the bus body interior and/or the exterior through a control device and pass it through the heater core to the defroster system and over the driver's feet. A minimum capacity of 100 cfm shall be provided. The driver shall have complete control of the heat and fresh airflow for the driver's area.
- The defroster supply outlets shall be located at the lower edge of the windshield. These outlets shall be durable and shall be free of sharp edges that can catch clothes during normal daily cleaning. The system shall be such that foreign objects such as coins or tickets cannot fall into the defroster air outlets. Adjustable ball vents or louvers shall be provided at the left of the driver's position to allow direction of air onto the side windows.

A ventilation system shall be provided to ensure driver comfort and shall be capable of providing fresh air in both the foot and head areas. Vents shall be controllable by the driver from the normal driving position. Decals shall be provided, indicating "operating instructions" and "open" and "closed" positions. When closed, vents shall be sealed to prevent the migration of water or air into the bus.

#### **TSE 54.5 Driver's Cooling**

##### **Separate Dedicated Evaporator**

Using a separate, dedicated evaporator, the Climate Control System shall be designed to maintain the driver's compartment temperatures within the range specified for the passenger compartment. The unit shall operate when the climate control switch is in the "Cool" position. It shall have a separate thermostatic control.

#### **OR**

A separate fan unit shall provide 100 cfm of air to the driver's area through directionally adjustable nozzles and an infinitely variable fan control, both of which shall be located above and ahead of the driver.

#### ***TSE 55. Air Filtration***

Air shall be filtered before discharge into the passenger compartment. The filter shall meet the ANSI/ASHRAE 52.1 requirement for 5 percent or better atmospheric dust spot efficiency, 50 percent weight arrestance, and a minimum dust holding capacity of 120 g per 1000 cfm cell. Air filters shall be easily removable for service.

Air filters shall be of disposable type.

#### ***TSE 56. Roof Ventilators***

Two roof ventilators shall be provided in the roof of the bus, one approximately over or just forward of the front axle and the other approximately over the rear axle.

Each ventilator shall be easily opened and closed manually. When open with the bus in motion, this ventilator shall provide fresh air inside the bus. The ventilator shall cover an opening area no less than 425 sq. in. and shall be capable of being positioned as a scoop with either the leading or trailing edge open no less than 4 in., or with all four edges raised simultaneously to a height of no less than 3½ in. An escape hatch shall be incorporated into the roof ventilator. Roof ventilator(s) shall be sealed to prevent entry of water when closed.

#### ***TSE 57. Maintainability***

Manually controlled shut-off valves in the refrigerant lines shall allow isolation of the compressor and dehydrator filter for service. To the extent practicable, self-sealing couplings utilizing O-ring seals shall be used to break and seal the refrigerant lines during removal of major components, such as the refrigerant compressor. Shut-off valves may be provided in lieu of self-sealing couplings. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed above the ambient temperature by the bus mechanical equipment, or to discharge air into any other system of the bus. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris. HVAC components located within 6 in. of floor level shall be constructed to resist damage and corrosion.

High and low refrigerant pressure electronic gauges to be located in the return air area.

***TSE 58. Entrance/exit area heating***

No requirements for entrance/exit area heating.

***TSE 59. Floor-Level Heating***

No requirements for floor-level heating.

**EXTERIOR PANELS, FINISHES AND EXTERIOR LIGHTING**

***TSE 60. Design***

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

Exterior panels shall be sufficiently stiff to minimize vibration, drumming or flexing while the bus is in service. When panels are lapped, the upper and forward panels shall act as a watershed. However, if entry of moisture into the interior of the vehicle is prevented by other means, then rear cap panels may be lapped otherwise. The windows, hatches and doors shall be able to be sealed. Accumulation of spray and splash generated by the bus's wheels shall be minimized on windows and mirrors.

***TSE 60.1 Materials***

Body materials shall be selected and the body fabricated to reduce maintenance, extend durability and provide consistency of appearance throughout the service life of the bus. Detailing shall be kept simple, and add-on devices and trim shall be minimized and integrated into the basic design.

No requirement for protection against graffiti/vandalism for body material surfaces.

***TSE 60.2 Roof-Mounted Equipment***

A non-skid, clearly marked walkway or steps shall be incorporated on the roof to provide access to equipment without damaging any system or bus paneling.

***TSE 61. Pedestrian Safety***

Exterior protrusions along the side and front of the bus greater than ½ in. and within 80 in. of the ground shall have a radius no less than the amount of the protrusion. The exterior rearview mirrors, cameras and required lights and reflectors are exempt from the protrusion requirement. Advertising frames shall protrude no more than ⅞ in. from the body surface. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize toeholds or handholds.

Exterior protrusions shall not cause a line-of-sight blockage for the driver.

***TSE 62. Repair and Replacement***

***TSE 62.1 Side Body Panels***

Structural elements supporting exterior body panels shall allow side body panels below the windows to be repaired in lengths not greater than 12.5 ft.

Standard attachment of side body panels.

### ***TSE 63. Rain Gutters***

Rain gutters shall be provided to prevent water flowing from the roof onto the passenger doors and driver's side window. When the bus is decelerated, the gutters shall not drain onto the windshield, driver's side window or door boarding area. Cross-sections of the gutters shall be adequate for proper operation.

### ***TSE 64. License Plate Provisions***

Provisions shall be made to mount a standard-size U.S./Canada license plate per SAE J686 on the rear of the bus. These provisions shall direct-mount or recess the license plate so that it can be cleaned by automatic bus-washing equipment without being caught by the brushes. The rear license plate provision shall be illuminated per SAE J587.

#### **TSE 64.1 Rub rails**

No requirement for rub rails.

### ***TSE 65. Fender Skirts***

Designed to cover the upper portions of the wheels shall be installed on the center and rear wheels and match the color of the bus body.

### ***TSE 66 Splash Aprons***

#### **Standard Splash Aprons**

Splash aprons, composed of ¼ in. minimum composition or rubberized fabric, shall be installed behind and/or in front of wheels as needed to reduce road splash and protect underfloor components. The splash aprons shall extend downward to within 6 in. off the road surface at static conditions. Apron widths shall be no less than tire widths. Splash aprons shall be bolted to the bus understructure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Splash apron shall be installed as necessary to protect the wheelchair loading device from road splash. Other splash aprons shall be installed where necessary to protect bus equipment.

### ***TSE 67. Service Compartments and Access Doors***

#### **TSE 67.1 Access Doors**

Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the engine coolant, engine lubricant and transmission fluid. Access openings shall be sized for easy performance of tasks within the compartment, including tool operating space. Access doors shall be of rugged construction and shall maintain mechanical integrity and function under normal operations throughout the service life of the bus. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be retained in the open position by props or counterbalancing with over-center or gas-filled springs with safety props and shall be easily operable by one person. Springs and hinges shall be corrosion resistant. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Access doors, when opened, shall not restrict access for servicing other components or systems.



If precluded by design, the manufacturer shall provide door design information specifying how the requirements are met.

A separate door will be required that will allow for access to the oil dipstick area.

## **TSE 67.2 Access Door Latch/Locks**

### **Requirement for Latches on Access Doors**

Access doors larger than 100 sq. in. in area shall be equipped with corrosion-resistant flush-mounted latches or locks except for coolant and fuel fill access doors. All such access doors that require a tool to open shall be standardized throughout the vehicle and will require a nominal 5/16 in. square male tool to open or lock.

## ***TSE 68. Bumpers***

### **TSE 68.1 Location**

Bumpers shall provide impact protection for the front and rear of the bus with the top of the bumper being 27 in.,  $\pm$  2 in., above the ground. Bumper height shall be such that when one bus is parked behind another, a portion of the bumper faces will contact each other.

### **TSE 68.2 Front Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 5 mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus's longitudinal centerline. The bumper shall return to its pre-impact shape within 10 minutes of the impact. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs parallel to the longitudinal centerline of the bus. It shall protect the bus from damage as a result of 5.5 mph impacts into the corners at a 30-degree angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

### **TSE 68.3 Rear Bumper**

No part of the bus, including the bumper, shall be damaged as a result of a 2 mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. The bumper shall return to its pre-impact shape within 10 minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 ft wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 in. high, and at accelerations up to 2 mph/sec. The rear bumper shall protect the bus, when impacted anywhere along its width by the common carriage with contoured impact surface defined in Figure 2 of FMVSS 301 loaded to 4000 lbs, at 4 mph parallel to or up to a 30-degree angle to, the longitudinal centerline of the bus. The rear bumper shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length specified by no more than 7 in.

### **TSE 68.4 Bumper Material**

Bumper material shall be corrosion-resistant and withstand repeated impacts of the specified loads without sustaining damage. Visible surfaces shall match the color of the bus. These bumper qualities shall be sustained throughout the service life of the bus.



***TSE 69. Finish and Color*****TSE 69.1 Appearance**

All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surfaces to be painted shall be properly prepared as required by the paint system Supplier prior to application of paint to assure a proper bond between the basic surface and successive coats of original paint for the service life of the bus. Drilled holes and cutouts in exterior surfaces shall be made prior to cleaning, priming and painting, where possible, to prevent corrosion. The bus shall be completely painted prior to installation of exterior lights, windows, mirrors and other items that are applied to the exterior of the bus. Body filler materials may be used for surface dressing, but not for repair of damaged or improperly fitted panels.

Paint shall be applied smoothly and evenly with the finished surface free of visible dirt and the following other imperfections:

- blisters or bubbles appearing in the topcoat film
- chips, scratches, or gouges of the surface finish
- cracks in the paint film
- craters where paint failed to cover due to surface contamination
- overspray
- peeling
- runs or sags from excessive flow and failure to adhere uniformly to the surface
- chemical stains and water spots
- dry patch due to incorrect mixing of paint activators
- buffing swirls

All exterior finished surfaces shall be impervious to diesel fuel, gasoline and commercial cleaning agents. Finished surfaces shall resist damage by controlled applications of commonly used graffiti-removing chemicals.

Proper adhesion between the basic surface and successive coats of the original paint shall be measured using an Elcometer adhesion tester as outlined in ASTM D4541-85. Adhesion shall be a minimum 300 ft.-lbs. The bus manufacturer shall supply test samples of the exterior surface for each step of the painting process that may be subject to adhesion testing per ASTM G4541-87 and ASTM D4145-85. ASTM D4541-93 may be used for inspection testing during assembly of the vehicle.

Standard Contractor exterior paint finish quality.

Water Based Basecoat/Clear Coat paint system.

**TSE 69.2 Color**

The base color of the bus, wheels and wheel covers is to be silver metallic. Additional details about other markings will be approved by the City of Albuquerque Transit Department prior to production of the buses.

***TSE 70. Decals, Numbering and Signing***

Monograms, numbers and other special signing shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade-, chip- and peel-resistant. They may be painted signs, decals or pressure-sensitive appliques, and they shall all incorporate reflective properties. All decals shall be installed per the decal Supplier recommendations. Signs shall be provided in compliance with the ADA requirements defined in 49 CFR Part, Subpart B, 38.27.

**NOTE:** Schematic for all decals and numbering will be provided upon award of contract. All decals and signs will be in both English and Spanish.

#### **TSE 70.1 Passenger Information**

ADA priority seating signs as required and defined by 49 CFR, Part 38.27 shall be provided to identify the seats designated for passengers with disabilities.

Requirements for a public information system in accordance with 49 CFR, Part 38.35 shall be provided.

#### ***TSE 71. Exterior Lighting***

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

All exterior lights shall be designed to prevent entry and accumulation of moisture or dust. Commercially available LED-type lamps shall be utilized at all exterior lamp locations. Lamps, lenses and fixtures shall be interchangeable to the extent practicable. Two hazard lamps at the rear of the bus shall be visible from behind when the engine service doors are opened. Light lenses shall be designed and located to prevent damage when running the vehicle through an automatic bus washer. Front marker (clearance) lights along with lights located on the roof and sides of the bus shall have protective shields or be of the flush mount type to protect the lens against minor impacts.

#### **Standard Lamps**

All LED lamps shall be standard installation of the OEM. The entire assembly shall be specifically coated to protect the light from chemical and abrasion degradation.

#### **Standard Size**

Size of LED lamps used for tail, brake and turn signal lamps shall be standard installation of OEM.

#### **TSE 71.1 Backup Light/Alarm**

Visible and audible warnings shall inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE Standard J593. Audible reverse operation warning shall conform to SAE Recommended Practice J994 Type C or D.

#### **TSE 71.2 Doorway Lighting**

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

#### **TSE 71.3 Turn Signals**

##### **Standard Turn Signals**

Turn-signal lights shall be provided on the front, rear, curb and street sides of the bus in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable. Turn signals shall also be built into the exterior of the curb and street side mirrors.

#### **TSE 71.4 Headlights**

Roved headlamps shall be designed for replacement without removing the headlamp bezel.

#### **Daytime Running Lights**

Headlamps shall incorporate a daytime running light feature.

#### **LED/Halogen**

Headlamps shall be LED/halogen, sealed beam.

#### **TSE 71.5 Brake Lights**

Brake lights shall be provided in accordance with FMVSS 108 and Part 393, Subpart B of the FMCSA as applicable.

#### **High and Center Mount Red Brake Lamp**

Bus shall include red, high and center mount brake lamp(s) along the backside of the bus in addition to the lower brake lamps required under FMVSS 108. The high and center mount brake lamp(s) shall illuminate steady with brake application.

#### **TSE 71.6 Service Area Lighting (Interior and Exterior)**

LED lamps shall be provided in the engine and all other compartments where service may be required to generally illuminate the area for night emergency repairs or adjustments. These service areas shall include, but not be limited to, the engine compartment, the communication box, junction/apparatus panels and passenger door operator compartments. Lighting shall be adequate to light the space of the service areas to levels needed to complete typical emergency repairs and adjustments. The service area lamps shall be suitable for the environment in which they are mounted.

Engine compartment lamps shall be controlled by a switch mounted near the rear start controls. All other service area lamps shall be controlled by switches mounted on or convenient to the lamp assemblies. Power to the service area lighting shall be programmable. Power shall latch on with activation of the switch and shall be automatically discontinued (timed out) after 30 minutes to prevent damage caused by inadvertently leaving the service area lighting switch in the on position after repairs are made.

### ***INTERIOR PANELS AND FINISHES***

#### ***TSE 72. General Requirements***

Materials shall be selected on the basis of maintenance, durability, appearance, safety, flammability and tactile qualities. Materials shall be strong enough to resist everyday abuse and be vandalism and corrosion resistant. Trim and attachment details shall be kept simple and unobtrusive. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions.

Interior surfaces more than 10 in. below the lower edge of the side windows or windshield shall be shaped so that objects placed on them fall to the floor when the coach is parked on a level surface. Any components and other electrical components within close proximity to these surfaces shall also be resistant to this cleaning method.

Requirements for additional anti-graffiti/vandalism treatments for interior surfaces.

**TSE 73. Interior Panels**

Panels shall be easily replaceable and tamper-resistant. They shall be reinforced, as necessary, to resist vandalism and other rigors of transit bus service. Individual trim panels and parts shall be interchangeable to the extent practicable.

Interior panel required to meet FMVSS 302.

**TSE 73.1 Driver Area Barrier**

A barrier or bulkhead will be located behind the driver's seat to separate the driver from the street-side front passenger seat. The Electronics Cabinet shall be incorporated into the Driver Area Barrier. This barrier shall minimize glare and reflections in the windshield directly in front of the barrier, and from interior lighting during night operation. Location and shape must permit full seat travel and reclining possibilities that can accommodate the shoulders of a 95th-percentile male. The barrier shall have a side return and stanchion to prevent passenger from reaching the driver by standing behind the driver's seat. The lower area between the seat and panel must be accessible to the driver. The barrier must be strong enough in conjunction with entire partition assembly for mounting of such equipment as flare kits, fire extinguishers (1.2 kg), microcomputer, public address amplifier, etc. Dark or black panels are preferred behind the driver's head. The panel should be isolated for noise control and attached with rubber grommets. Includes sufficient clearance for access by a wheelchair.

**TSE 73.2 Modesty Panels**

Sturdy divider panels constructed of durable, unpainted, corrosion-resistant material complementing the interior shall be provided to act as both a physical and visual barrier for seated passengers.

Design and installation of modesty panels located in front of forward-facing seats shall include a handhold or grab handle along its top edge. These dividers shall be mounted on the sidewall and shall project toward the aisle no farther than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend from at least the window opening of the side windows, and those forward of transverse seats shall extend downward to 1 and 1½ in. above the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the doorways shall provide no less than a 2½ in. clearance between the modesty panel and a fully open, inward opening door, or the path of a deploying flip-out ramp to protect passengers from being pinched. Modesty panels installed at doorways shall be equipped with grab rails if passengers assist are not provided by other means.

The modesty panel and its mounting shall withstand a static force of 250 lbs applied to a 4 × 4 in. area in the center of the panel without permanent visible deformation.

Clear non-glass panel from above the modesty panel to the top of the daylight opening and attached to the stanchion.

**TSE 73.3 Front End**

The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the driver's feet from kicking or fouling wiring and other equipment. The front end shall be free of protrusions that are hazardous to passengers standing at the front of the standee line area of the bus during rapid decelerations. Paneling across the front of the bus and any trim around the driver's compartment shall be formed metal or composite material. Composite dash panels shall be reinforced as necessary, vandal-resistant and replaceable. All colored, painted and plated parts



forward of the driver's barrier shall be finished with a surface that reduces glare. Any mounted equipment must have provision to support the weight of equipment.

#### **TSE 73.4 Rear Bulkhead**

The rear bulkhead and rear interior surfaces shall be material suitable for exterior skin; painted and finished to exterior quality; or paneled with melamine-type material, composite, scratch-resistant plastic and trimmed with stainless steel.

The rear bulkhead paneling shall be contoured to fit the ceiling, side walls and seat backs so that any litter or trash will tend to fall to the floor or seating surface when the bus is on a level surface. Any air vents in this area shall be louvered to reduce airflow noise and to reduce the probability of trash or litter being thrown or drawn through the grille. If it is necessary to remove the panel to service components located on the rear bulkhead, the panel shall be hinged or shall be able to be easily removed and replaced. Grilles where access to or adjustment of equipment is required shall be heavy-duty and designed to minimize damage and limit unauthorized access.

#### **TSE 73.5 Headlining**

Ceiling panels shall be made of durable, corrosion resistant, easily cleanable material. Headlining shall be supported to prevent buckling, drumming or flexing and shall be secured without loose edges. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trim strips, as required to make the edges tamperproof, shall be stainless steel, aluminum or plastic, colored to complement the ceiling material. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening.

#### **TSE 73.6 Fastening**

Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Fasteners should be corrosion resistant. Panels and fasteners shall not be easily removable by passengers. Exposed interior fasteners should be minimized, and where required shall be tamper-resistant.

#### **TSE 73.7 Insulation**

Any insulation material used between the inner and outer panels shall minimize the entry and/or retention of moisture. Insulation properties shall be unimpaired during the service life of the bus. Any insulation material used inside the engine compartment shall not absorb or retain oils or water and shall be designed to prevent casual damage that may occur during maintenance operations.

The combination of inner and outer panels on the sides, roof, wheel wells and ends of the bus, and any material used between these panels, shall provide a thermal insulation sufficient to meet the interior temperature requirements. The bus body shall be thoroughly sealed so that the driver or passengers cannot feel drafts during normal operations with the passenger doors closed.

#### **FMVSS 302**

Insulation shall meet the requirements of FMVSS 302.

#### **TSE 73.8 Floor Covering**

The floor covering shall have a non-skid walking surface that remains effective in all weather conditions. The floor covering, as well as transitions of flooring material to the main floor and to the entrance and exit area, shall be smooth and present no tripping hazards. Seams shall be



sealed/welded per manufacturer's specifications. The standee line shall be approximately 2 in. wide and shall extend across the bus aisle. The color and pattern shall be consistent throughout the floor covering. Altro Flooring, color to be specified later.

#### **Additional Requirements**

Any areas on the floor that are not intended for standees, such as areas "swept" during passenger door operation, shall be clearly and permanently marked.

The floor shall be easily cleaned and shall be arranged to minimize debris accumulation.

A one-piece center strip shall extend from the vertical wall of the rear settee between the aisle sides of transverse seats to the standee line. If the floor is of a bi-level construction, then the center strip shall be one piece at each level. The covering between the center strip and the wheel housings may be separate pieces. At the rear door, however, a separate strip as wide as the door shall extend from the center strip to the outboard edge of the rear/exit area.

The floor under the seats shall be covered with smooth surface flooring material. The floor covering shall closely fit the sidewall in a fully sealed butt joint or extend to the top of the cove.

#### **TSE 73.9 Interior Lighting**

The lights shall be LED lights. The light source shall be located to minimize windshield glare, with distribution of the light focused primarily on the passengers' reading plane while casting sufficient light onto the advertising display. The lighting system may be designed to form part of or the entire air distribution duct.

The lens material shall be translucent polycarbonate. Lenses shall be designed to effectively "mask" the light source. Lenses shall be sealed to inhibit incursion of dust and insects yet be easily removable for service. Access panels shall be provided to allow servicing of components located behind light panels. If necessary, the entire light fixture shall be hinged.

#### **TSE 73.10 Passenger**

##### **Dimming Second Row Lights**

To help eliminate windshield reflection on suburban roads where street lighting is at a low level, the second light on each side, when "night run" or "night park" is selected, shall be controlled by the toggle switch; off in "off" and on in "normal." These lights shall be turned on at any time if the toggle switch is in the "on" position.

The interior lighting design shall require the approval of the City.

LED lights.

##### **First Light Modules Dim/Extinguish When Front Door is Closed**

When the master switch is in the "run" or "night/run" mode, the first light module on each side of the coach shall automatically extinguish or dim when the front door is in the closed position and illuminate when the door is opened. This shall be accomplished through the use of a ballast specifically designed for this type application without diminishing the life of the fluorescent tubes.

**TSE 73.11 Driver Area**

The driver's area shall have a light to provide general illumination, and it shall illuminate the half of the steering wheel nearest the driver to a level of 5 to 10 foot-candles.

**TSE 73.12 Seating Areas**

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

**TSE 73.13 Vestibules/Doors**

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

**TSE 73.14 Step Lighting**

Step lighting for the intermediate steps between lower and upper floor levels shall be a minimum of 4 foot-candles and shall illuminate in all engine run positions. The step lighting shall be low-profile to minimize tripping and snagging hazards for passengers and shall be shielded as necessary to protect passengers' eyes from glare.

**TSE 73.15 Ramp Lighting**

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

**TSE 73.16 Turntable Lighting**

Lighting in the turntable can be reduced to 7 foot-candles.

**TSE 73.17 Farebox Lighting**

A light fixture shall be mounted in the ceiling above the farebox location. The fixture shall be capable of projecting a concentrated beam of light on the farebox. This light will automatically come on whenever the front doors are opened and the run switch is in the "night run" or "night park" position.

***TSE 74. Fare Collection***

The fare collection system is to be completely installed at the factory. Location of the fare collection device shall not restrict traffic in the vestibule, including wheelchairs if a front door loading device is used, and shall allow the driver to easily reach the farebox controls and to view the fare register. The fare box shall not restrict access to the driver area, shall not restrict operation of driver controls and shall not — either by itself or in combination with stanchions, transfer mounting, cutting and punching equipment, or route destination signs — restrict the driver's field of view per SAE Recommended Practice J1050. The location and mounting of the fare collection device shall allow use, without restriction, by passengers. The fare box location shall permit accessibility to the vault for easy manual removal or attachment of suction devices. Meters and counters on the fare box shall be readable on a daily basis. The floor under the fare box shall be reinforced as necessary to provide a sturdy mounting platform and to prevent shaking of the fare box.

The Albuquerque Transit Department will provide a template so that the fare box and be mounted at the proper angle.

Odyssey by Gen Fare (price with and without smartcard options). It shall contain the largest cashbox available and is not to accept tokens.

#### ***TSE 75. Interior Access Panels and Doors***

Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Access doors shall be hinged with gas props or over-center springs, where practical, to hold the doors out of the mechanic's way. Panels shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover.

#### **Access Doors with Locks**

Access doors shall be secured with locks. The locks shall be standardized so that only one tool is required to open access doors on the bus.

#### **TSE 75.1 Floor Panels**

Access openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring material at or around access openings shall be flush with the floor and shall be edge-bound with stainless steel or another material that is acceptable to the City to prevent the edges from coming loose. Access openings shall be asymmetrical so that reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor.

The number of special fastener tools required for panel and access door fasteners shall be minimized.

### **PASSENGER ACCOMMODATIONS**

#### ***TSE 76. Passenger Seating***

#### **TSE 76.1 Arrangements and Seat Style**

The passenger seating arrangement in the bus shall be such that seating capacity is maximized and in compliance to the following requirements allowing for a minimum of **44** seated passengers. There will be no seating in the Bicycle Area. See details in TS 76.10.

Note: The City recognizes that ramp location, foot room, hip-to-knee room, doorway type, width, seat construction, floor level type, seat spacing requirements, ramp or lift, number of wheelchair positions, etc. ultimately affect seating capacity and layout.

#### **Forward-Facing Seat Configuration**

Passenger seats shall be arranged in a transverse, forward-facing configuration, except at the wheel housings 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, the accessible path from center doors to wheelchair securement areas, and platforms (such as for fuel tank storage space).

#### **TSE 76.2 Rearward Facing Seats**

Rearward facing seats not allowed.

**TSE 76.3 Turntable Seating** – There shall be seating for 4 passengers inside of the turntable, compatible with the rest of the seating on board.

**TSE76.4 Passenger Seat Specification Stainless (Aries 4MA)**

Passenger seating shall be either 4ONE Aries 4MA, or American Seating Insight. Seating shall meet or exceed all Federal Procurement Guidelines (White Book) standards and requirements and meet the following specifications.

**GENERAL:** The seat shall be ergonomically designed and shaped to provide optimal lumbar, kidney area, and buttocks support. Seats for the various seating arrangements shall have the dimensions shown in the following figure.

**LOGO:** Albuquerque Transit Department will provide a branding logo to appear on seatbacks.

**USB CHARGING PORTS:** A USB charging port will be available for use at each passenger seat. Each port will have an LED that when lit will indicate power is available to the port. The exact location must be approved in advance in a location that cannot be in a place where it interferes with the cleaning of the bus.

**OPTIONAL SEAT WIDTH OF 37"**

The thickness of the transverse seat backs shall be minimized to increase passenger knee room and bus capacity. The backrest shall not be thicker than 1" at the edges and 1/2" in the center when utilizing "T2C" vandal resistant inserts. A curved backrest shall allow the seat hip-to-knee measurement to be greater than the seat pitch.

Seat backrests shall taper toward the top to accommodate required aisle spacing. The aisle between the seats on a 102" wide bus shall be no less than 20" wide at seated passenger hip height and no less than 24" at standing passenger hip height. The aisle between the seats on a 96" wide bus shall be no less than 16" wide at seated passenger hip height and no less than 20" at standing passenger hip height.

Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14". Seats immediately behind the wheel housings may have foot room reduced, provided the wheelhouse is shaped so that it may be used as a footrest.

**SEAT FRAME:** Each seated position shall have its own seat frame assembly. The seat shall have well defined individual seating positions. All metal of the standard seat structure including the frame, cantilever, pedestals, beams, mounting brackets and other components shall be stainless steel with beaded finish. The frame shall be constructed of 25mm OD tube with 2mm wall thickness.

The passenger seat frame and its supporting structure shall be constructed and mounted so that space under the seat is maximized to facilitate cleaning. Cantilevered seats shall be mounted to the sidewall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12" of the aisle shall be at least 10" above the floor. Cantilever assemblies must be collapsible with pivoting linkages at the lower wall mounting bracket and the junction between the cantilever leg and beam assembly. The lowest part of a pedestal-mounted seat that is within 12" of the aisle, excluding the pedestal, shall be at least 10" above the floor.



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 Critical requirements. 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".

The seat shall be supplied with a stainless steel spacer that closes any gaps between the seat frames. The spacer shall run the entire length of the seat cushion and backrest.

**SEAT CUSHIONS / INSERTS:** The seat and backrest cushions shall extend the full width and height of the seat frame with a minimum width of 15.5" of upholstery. The upholstery material shall come into contact with the seat frame to maximize the amount of upholstered surface area that is in contact with the seated passenger. The seat cushion assembly shall have a waterfall front edge.

The cushions shall be padded with a cellular foam product that complies with the physical test requirements and is no less than 1/2" thick in areas contacted and loaded by passengers in the normal seated position. (Alternatively: The cushions shall have no padding; the upholstery is to be bonded directly to the cushion insert – T2C). The inserts shall be covered with vinyl and/or fabric material. Seat covering materials shall be selected on the basis of durability, ease of maintenance, and pleasing texture and appearance.

Additionally, the padded cushions may also be vandal resistant "PT2C" (padded tough-to-cut)

Inserts shall be securely attached by replaceable fasteners. Service time to exchange the inserts shall not exceed three minutes. The inserts shall be either injection molded or fiberglass construction. All inserts should be interchangeable throughout the bus, with the exception of when using a slim flip seat application.

**BACK SHROUD:** The seat back shall be covered with a brushed stainless steel back shroud that covers the entire backrest. The stainless steel construction shall minimize damage from vandalism and shall reduce cleaning time. The structure including the flat thermoform back shroud must meet all the test requirements of the Federal Procurement Guidelines (White Book) as listed below. These include a HIC value of less than 400. All fasteners shall be hidden. The back shroud shall be quickly and easily removed by mechanics, but not by passengers.

**GRAB RAIL:** The back of each transverse seat shall incorporate a handhold no less than 7/8" in diameter for standees and seat access/egress. Individual handholds shall be mounted to each seat frame. The service time to exchange grab handles shall not exceed five minutes. The handhold shall not be a safety hazard during severe decelerations. The handhold of all aisle seats shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4" 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. Handholds on seats not directly on the aisle shall be maximum 3" tall to allow maximum visibility of the seated occupants behind the seat. Each 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. All grab rails shall be curved to match the curvature of an occupants back torso. Longitudinal seats shall be the same general design as transverse seats but without grab rails.



**TEST REQUIREMENTS:** 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 " .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", measured at the aisle side of the seat frame at height H. Seat back should not deflect more than 14", 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" 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" 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" pendulum and shall strike the seat back 10,000 times each from distances of 6, 8, 10, and 12". 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". Seat cushions shall withstand 100,000 randomly positioned 3-1/2" 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.

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 6 year old child 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.

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" permanent formation.

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" permanent deformation and without visible deterioration.

**REPORTING REQUIREMENTS:** The Contractor shall be capable of providing a test report fully documenting 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 the Federal Procurement Guidelines (White Book), section 5: Technical Specifications. Testing must be done by an independent, certified testing facility.

**WHEELCHAIR ACCOMMODATIONS:** Two locations, as close to the wheelchair loading systems as practical, shall provide parking space and secure tie-down for a passenger in a wheelchair. Additional equipment, including passenger restraint seat belts and wheelchair securement devices shall be provided for two wheelchair passengers. Passenger restraint seat belts shall be provided to accommodate passengers in electrically powered wheelchairs. All belt assemblies must stow up and out of the way when not in use.

**TSE 76.5 Hip-to-Knee Room Insert 76.5 from original Drain Holes in Seat**

Hip-to-knee room measured from the center of the seating position, from the front of one seat back horizontally across the highest part of the seat to vertical surface immediately in front, shall be a minimum of 26 in. At all seating positions in paired transverse seats immediately behind other seating positions, hip-to-knee room shall be no less than 27 in.

**TSE 76.6 Foot Room**

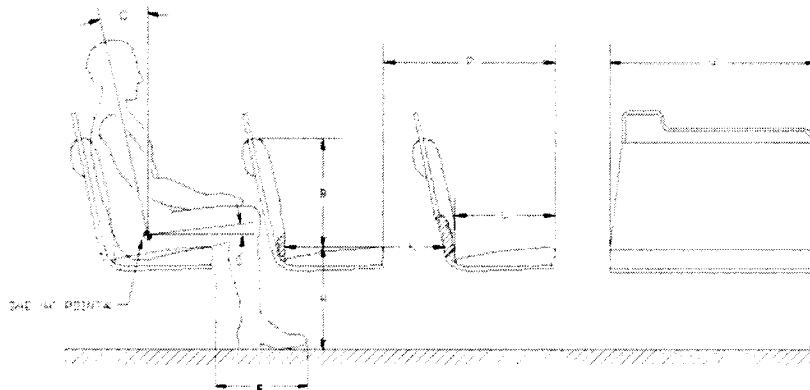
Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 14 in. Seats immediately behind the wheel housings and modesty panels may have foot room reduced.

**TSE 76.7 Aisles**

The aisle between the seats shall be no less than 20 in. wide at seated passenger hip height. Seat backs shall be shaped to increase this dimension to no less than 24 in. at 32 in. above the floor (standing passenger hip height). There shall be an ADA compliant wheelchair accessible route from the Center doors to the securement areas at the front of the bus.

**TSE 76.8 Dimensions**

**FIGURE 7**  
Seating Dimensions and Standard Configuration



Seat dimensions for the various seating arrangements shall have the dimensions as follows (refer to Figure 7):

- The width, W, of the two-passenger transverse seat shall be a minimum 35 in.
- The length, L, shall be 17 in.,  $\pm 1$  in.
- The seat back height, B, shall be a minimum of 15 in.
- The seat height, H, shall be 17 in.,  $\pm 1$  in. For the rear lounge (or settee) and longitudinal seats, and seats located above raised areas for storage of under-floor components, a cushion height of up to 18 in.,  $\pm 2$  in., will be allowed. This shall also be allowed for limited transverse seats, but only with the expressed approval of the City.
- Foot room = F.
- The seat cushion slope, S, shall be between 5 and 11 degrees.
- The seat back slope, C, shall be between 8 and 17 degrees.

- Hip to knee room = K.
- The pitch, P, is shown as reference only.

### **TSE 76.9 Construction and Materials**

Selected materials shall minimize damage from vandalism and shall reduce cleaning time. The seats shall be attached to the frame with tamper-resistant fasteners. Coloring shall be consistent throughout the seat material, with no visually exposed portion painted. Any exposed metal touching the sides or the floor of the bus shall be stainless steel. The seat, pads and cushions shall be contoured for individuality, lateral support and maximum comfort and shall fit the framework to reduce exposed edges.

The minimum radius of any part of the seat back, handhold or modesty panel in the head or chest impact zone shall be a nominal ¼-in. The seat back and seat back handhold immediately forward of transverse seats shall be constructed of energy-absorbing materials to provide passenger protection and, in a severe crash, allow the passenger to deform the seating materials in the impact areas. Complete seat assemblies shall be interchangeable to the extent practicable.

City to select seat fabric.

### **TSE 76.10 Bicycle Storage Area**

Interior bicycle storage will be on both sides of the bus from just forward of the rear doors to the rear of the turntable and bellows area. There will be no seating in this space. Continuous, full grip, overhead assists shall be provided for riders on the curb-side (see TS 77.5 below). Vertical assists shall be provided immediately forward of the curb-side rear doors and immediately to the rear of the turntable on both sides (see TS 77.4 below). Bicycle racks for three bicycles may be installed on the street-side area. We may provide our own racks. **Please present pricing for:**

- **Cost of the racks and installation for racks you would provide. Racks would be installed on the street-side in front of the rear door and store three (3) bicycles, with no racks or seating on the curb-side.**

### ***TSE 77. Passenger Assists***

Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and the 5th-percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of seat back assist or as a separate item so that a 5th-percentile female passenger may easily move from one assist to another using one hand and the other without losing support. All handholds and stanchions at front doorway, around farebox, and at interior steps for bi-level designs shall be powder-coated in a high-contrast yellow color. The forward-most vertical stanchions on either side of the aisle immediately behind the driver's area shall be:

Stainless steel finish.

### **TSE 77.1 Assists**

Excluding those mounted on the seats and doors, the assists shall have a cross-sectional diameter between 1 ¼ and 1 ½ in. or shall provide an equivalent gripping surface with no corner radii less than ¼ in. All passenger assists shall permit a full hand grip with no less than 1 ½ in. of knuckle clearance

around the assist. Passenger assists shall be designed to minimize catching or snagging of clothes or personal items and shall be capable of passing the NHTSA Drawstring Test.

Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. Seat handholds may be of the same construction and finish as the seat frame. Door mounted passenger assists shall be of anodized aluminum, stainless steel or powder-coated metal. Connecting tees and angles may be powder-coated metal castings. Assists shall withstand a force of 300 lbs applied over a 12-in. lineal dimension in any direction normal to the assist without permanent visible deformation. All passenger assist components, including brackets, clamps, screw heads and other fasteners used on the passenger assists shall be designed to eliminate pinching, snagging and cutting hazards and shall be free from burrs or rough edges.

#### **TSE 77.2 Front Doorway**

Front doors, or the entry area, shall be fitted with ADA-compliant assists. Assists shall be as far outward as practicable, but shall be located no farther inboard than 6 in. from the outside edge of the entrance step and shall be easily grasped by a 5th-percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assist and the assists on the wheel housing or on the front modesty panel.

#### **TSE 77.3 Vestibule**

The aisle side of the driver's barrier, the wheel housings, and when applicable the modesty panels shall be fitted with vertical passenger assists that are functionally continuous with the overhead assist and that extend to within 36 in. of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm.

A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The assist shall be no less than 36 in. above the floor. The assists at the front of the bus shall be arranged to permit a 5th-percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the driver's barrier, wheel housings or front modesty panel.

#### **TSE 77.4 Rear Doorway(s)**

Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel(s). Passenger assists shall be provided on modesty panels that are functionally continuous with the rear door assists. Rear doors, or the exit area, shall be fitted with assists having a cross-sectional diameter between 1¼ and 1½ in. or providing an equivalent gripping surface with no corner radii less than ¼ in., and shall provide at least 1½ in. of knuckle clearance between the assists and their mounting. The assists shall be designed to permit a 5th-percentile female to easily move from one assist to another during the entire exiting process. The assists shall be located no farther inboard than 6 in. from the outside edge of the rear doorway step.

#### **TSE 77.5 Overhead**

Except forward of the standee line and at the rear door, a continuous, full grip, overhead assist shall be provided. This assist shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 in. above the floor.

Grab straps or other extensions as necessary shall be provided for sections where vertical assists are not available and for the use by passengers that cannot reach to 70 in. Grab straps shall be fabric. Overhead assists shall simultaneously support 150 lbs on any 12-in. length. No more than 5 percent of the full grip feature shall be lost due to assist supports.

#### **TSE 77.6 Longitudinal Seat Assists**

Longitudinal seats shall have vertical assists located between every other designated seating position, except for seats that fold/flip up to accommodate wheelchair securement. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practicable and shall be no more than 52 in. apart or functionally continuous for a 5th percentile female passenger.

#### **TSE 77.7 Wheel Housing Barriers/Assists**

Unless passenger seating is provided on top of wheel housing, passenger assists shall be mounted around the exposed sides of the wheel housings (and propulsion compartments if applicable), which shall also be designed to prevent passengers from sitting on wheel housings. Such passenger assists shall also effectively retain items, such as bags and luggage, placed on top of wheel housing.

#### ***TSE 78. Passenger Doors***

Doorways will be provided in the locations and styles as follows. Passenger doors and doorways shall comply with ADA requirements.

#### **Operation**

The operation of the curb-side doors and the street-side doors shall be independent. When the Street-side doors are actuated, the curb-side doors shall be locked out and actuation impossible. When the curb-side doors are actuated, the street-side doors shall be locked out and actuation impossible. Operation of, and power to the passenger doors shall be completely controlled by the operator. The passenger doors shall be electric powered.

**TABLE 7**  
Door Operating  
Combinations

<b>Front</b>	<b>Center</b>	<b>Rear</b>
Open	Closed	Closed
Open	Open	Closed
Open	Open	Open
Closed	Open	Open
Closed	Closed	Open
Closed	Closed	Closed

#### **Materials and Construction**

Structure of the doors, their attachments, inside and outside trim panels and any mechanism exposed to the elements shall be corrosion-resistant. Door panel construction shall be of corrosion-resistant metal or reinforced non-metallic composite materials. When fully opened, the doors shall provide a firm support and

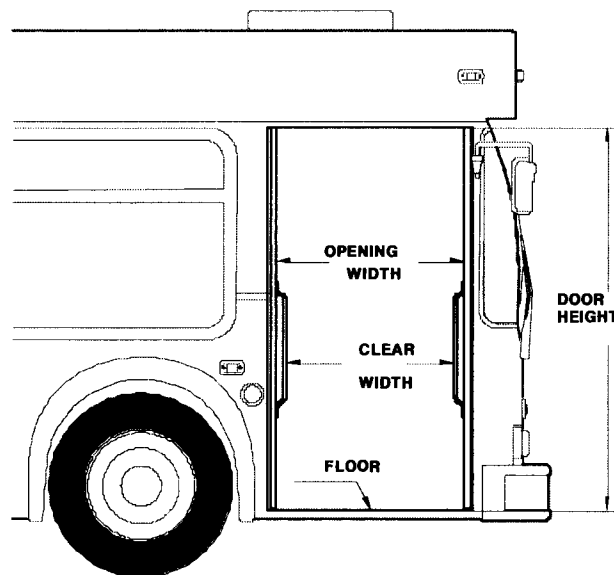


shall not be damaged if used as an assist by passengers during ingress or egress. Door edges shall be sealed to prevent infiltration of exterior moisture, noise, dirt and air elements from entering the passenger compartment, to the maximum extent possible based on door types.

The closing edge of each door panel shall have no less than 2 in. of soft weather stripping. The doors, when closed, shall be effectively sealed, and the hard surfaces of the doors shall be at least 4 in. apart. The combined weather seal and window glazing elements of the front door shall not exceed 10 degrees of binocular obstruction of the driver's view through the closed door.

### TSE 78.1 Dimensions

**FIGURE 8**  
Transit Bus Minimum Door Opening



When open, the front door shall leave an opening no less than 75.3 in. in height.

The rear door clear width shall be a minimum of 44 in. with the doors fully opened.

### TSE 78.2 Door Glazing

The upper section of all doors shall be glazed for no less than 45 percent of the respective door opening area of each section. The lower section of the front door shall be glazed for no less than 25 percent of the door opening area of the section.

Door glazing shall be easily replaceable. Zip type glazing rubber.

All doors window glazing material shall be Thermo Guard Blue Spruce 70. The glazing shall have 6 mm laminated heat-treated safety glass. The material shall conform to the requirements of ANSI Z26.1 and the Recommended Practices defined in SAJ673. The tint shall be blue with 70% LT or greater and comply with AS2 DOT requirements, blocking 99% of the UV and allowing less than 3–6% of the infrared heat to pass through the pane.

### **TSE 78.3 Door Projection**

#### **Exterior**

The exterior projection of the front doors beyond the side of the bus shall be minimized and shall not block the line of sight of the rear exit doors via the curb side mirror when the doors are fully open. The exterior projection of both doors shall be minimized and shall not exceed 13 in. during the opening or closing cycles or when doors are fully opened.

#### **Interior**

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

### **TSE 78.4 Door Height Above Pavement**

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

### **TSE 78.5 Closing Force**

Closing door edge speed shall not exceed 12 in. per second, and opening door speed shall not exceed 19 in. per second. Power doors shall not slam closed under any circumstance, even if the door is obstructed during the closing cycle. If a door is obstructed during the closing cycle, the pressure exerted on the obstruction shall not increase once initial contact has been made.

Power-close rear doors shall be equipped with an obstruction sensing system such that if an obstruction is within the path of the closing doors, the doors will stop and/or reverse direction prior to imparting a 10-lb force on 1 sq. in. of that obstruction. If a contactless obstruction sensing system is employed, it shall be capable of discriminating between the normal doorway environment and passengers or other obstructions within the doorway, and of altering the zones of detection based upon the operating state of the door system.

Doors closed by a return spring or counterweight-type device shall be equipped with an obstruction-sensing device that, at a minimum, alerts the driver if an obstruction is detected between the closing doors. Doors closed by a return spring or counterweight type device, when unlocked, shall be capable of being pushed to the point where the door starts to open with a force not to exceed 25 lbs applied to the center edge of the forward door panel.

Whether or not the obstruction sensing system is present or functional, it shall be possible to withdraw a 1½ in. diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than 35 lbs.

### **TSE 78.6 Actuators**

Doors shall open or close completely in not more than 3.5 seconds from the time of control actuation and shall be subject to the closing force requirements.

Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjustable to satisfy the above requirements. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. The door actuators shall be re-buildable. If powered by compressed air, exhaust from the door system shall be routed below the floor of the bus to prevent accumulation of any oil that may be present in the air system and to muffle sound.

Door actuators and associated linkages shall maximize door holding forces in the fully open and fully closed positions to provide firm, non-rattling, non-fluttering door panels while minimizing the force exerted by the doors on an obstruction midway between the fully open and closed positions.

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

A switch located within reach of the seated operator shall, when actuated, restore rear door function to complete operator control, as described in the "Default."

Doors that employ a "swing" or pantograph geometry and/or are closed by a return spring or counterweight-type device shall be equipped with a positive mechanical holding device that automatically engages and prevents the actuation mechanism from being back-driven from the fully closed position. The holding device shall be overcome only when the driver's door control is moved to an "Exit Door Enable" position and the vehicle is moving at a speed of less than 2 mph, or in the event of actuation of the emergency door release.

Locked doors shall require a force of more than 300 lbs. to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, actuators or complex mechanism.

#### **TSE 78.7 Rear Door Interlocks**

See "Hardware Mounting" for door system interlock requirements.

#### **TSE 78.8 Emergency Operation**

In the event of an emergency, it shall be possible to manually open doors designated as emergency exits from inside the bus using a force of no more than 25 lbs. after actuating an unlocking device. The unlocking device shall be clearly marked as an emergency-only device and shall require two distinct actions to actuate. The respective door emergency unlocking device shall be accessible from the doorway area. The unlocking device shall be easily reset by the operator without special tools or opening the door mechanism enclosure. Doors that are required to be classified as "Emergency Exits" shall meet the requirements of FMVSS 217.

#### **TSE 78.9 Door Control**

The door control shall be located in the operator's area within the hand reach envelope described in SAE Recommended Practice J287, "Driver Hand Control Reach." The driver's door control shall provide tactile feedback to indicate commanded door position and resist inadvertent door actuation.

Door control located on street side. The front door shall remain in commanded state position even if power is removed or lost.

#### **TSE 78.10 Door Controller**

##### **Push-Button Door Controls**

Doors shall be operated by push-button controls, conveniently located and operable within the driver's reach. The push buttons shall be labeled. There shall be a separate set of push button controls for the curb-side and street-side doors as needed.

**TSE 78.11 Door Open/Close****Operator-Controlled Front and Passenger-Controlled Rear Doors with Provision for Driver Override**

Operation of, and power to, the front passenger doors shall be completely controlled by the operator. Power to rear doors shall be controlled by operator. After enabling, the rear doors shall be opened by the passenger. A switch shall be provided to enable the driver to obtain full control of the rear doors.

A control or valve in the operator's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the bus shut down. A master door switch, which is not within reach of the seated operator, when set in the "off" position shall close the rear/center doors, deactivate the door control system, release the interlocks, and permit only manual operation of the rear/center doors.

***TSE 79. Accessibility Provisions***

Space and body structural provisions shall be provided at all curb-side and street-side doors of the bus to accommodate wheelchair loading systems.

**TSE 79.1 Loading Systems**

- low-floor ramp - front curb-side door
- fold out bridging plate or docking ramp – all other doors

**TSE 79.2 Loading System for 30- to 60-ft Low-Floor Bus**

An automatically-controlled, power-operated ramp system compliant to requirements defined in 49 CFR Part 38, Subpart B, §38.23c shall provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level platform, street or curb.

**Front Door Location of Loading System, Flip-Out Design Ramp with 6:1 Slope**

The wheelchair loading system shall be located at the curb-side front door, with the ramp being of a simple hinged, flip-out type design being capable of deploying to the ground at a maximum 6:1 slope.

**TSE 79.3 Loading System for Level Boarding on a 60-ft Low-Floor BRT** Fold out bridge plates/docking ramps shall be installed on both the street-side doors and middle and rear curb-side doors to insure that passengers with mobility devices can easily cross up to a 12-inch gap between the station platforms and the bus.

**TSE 79.4 Wheelchair Accommodations**

One Qstraint Q'Pod System and One Qstraint Quantum System shall be provided for a total of two positions to secure mobility devices. As a backup tie down system for the Quantum, a model Q-8300-A1-SC should be installed with the Quantum to be used to secure wheelchairs should the Quantum unit fail. These restraint systems will be located in the front of the bus near the operator's position.

**One Forward-Facing, and One Rear-Facing Wheelchair Securement Location**

One forward-facing location, and one rear-facing location, as close to the wheelchair loading system as practical, shall provide parking space and securement system compliant with ADA requirements for a passenger in a wheelchair.

**TSE 79.5 Interior Circulation**

Maneuvering room inside the bus shall accommodate easy travel for a passenger in a wheelchair from the loading device and from the designated securement area. It shall be designed so that no portion of the wheelchair protrudes into the aisle of the bus when parked in the designated parking space(s). When the positions are fully utilized, an aisle space of no less than 20 in. shall be maintained. As a guide, no width dimension should be less than 34 in. Areas requiring 90-degree turns of wheelchairs should have a clearance arc dimension no less than 45 in., and in the parking area where 180-degree turns are expected, space should be clear in a full 60-in.-diameter circle. A vertical clearance of 12 in. above the floor surface should be provided on the outside of turning areas for wheelchair footrest.

**SIGNAGE AND COMMUNICATION*****TSE 80. Destination Signs***

A Hanover destination sign system shall be furnished on the front, one on the curb-side behind the front door; one the street-side behind the front door and route sign on the rear of the vehicle.

**Current Specs:**

Front: 66" x 11"

Curb-Side: 50-5/8" x 8.25" (LED Matrix)

Street-Side: 50-5/8" x 8.25" (LED Matrix)

Rear: 21" x 9"

Controller: (E420F)

**Street Side, Curb Side and Route Signs**

The street-side and curb-side signs will each be at the large window immediately forward of the center bus doors. Display areas of destination signs shall be clearly visible in direct sunlight and/or at night. Parts shall be commercially available.

All signs shall be controlled via a single human-machine interface (HMI), which will serve as the secondary control unit for the signs. The buses will be equipped with a single mobile data terminal (MDT), sometimes referred to as an Operator Control Unit (OCU), which interfaces with the sign controller. For that reason, the HMI is used only in unusual circumstances. It can be mounted in the bulkhead storage compartment or other location, accessible by the driver, but it does not have to be within reach of a seated driver.

The destination sign compartments shall meet the following minimum requirements:

- Compartments shall be designed to prevent condensation and entry of moisture and dirt.
- Compartments shall be designed to prevent fogging of both compartment window and glazing on unit itself.
- Access shall be provided to allow cleaning of inside compartment window and unit glazing.
- Front window shall have an exterior display area of no less than 8.5 in. high by 56 in. wide.

***TSE 81. Passenger Information*****TS 81.1 Train Bell Sound**



Equip the bus with an electronic bell or gong sound similar to the bell a train uses when stopping at a station. The operator has a control switch to warn passengers inside and outside that the bus is approaching the station platform. This feature must not override ADA announcements and be independent of the horn.

## **TSE 82. Interior Displays**

### **TSE 82.1 Vandalism Discouragement Display**

An LCD screen mounted on the rear facing portion of the electronics cabinet shall be installed. The LCD screen must be a minimum of 17" and must have component (RCA) video input. A coax cable shall be connected from the back of DVR2's BNC connection to this screen.

Please provide a price for the following option:

### **TSE 82.2 Optional Infotainment System**

The bus shall come equipped with an Infotainment system including the management system on the backend and the public display LCD screens on the vehicles. To effectively communicate with all passengers aboard the bus, each bus will be required to have at least 2 LCD screens devoted to this purpose. Audio is not required for the Infotainment system.

The system shall be capable of the following:

4. Provide travel information to the passengers. The information to be provided should include:
  - Ad hoc messages about travel delays or detours
  - Real time travel and location information – show the estimated time of arrival of the bus at upcoming stations or show a map of the current location of the bus and the next 2 or 3 stations on the route;
5. ABQ RIDE agency information, including upcoming events or service provided during upcoming holidays
6. Provide advertising to passengers, either on a continuous loop or geospatially triggered.

The content shall be accessible for update over cellular communications (each bus is already equipped with a 4G modem with a fixed IP address) or through Wi-Fi (each bus is already equipped with a router capable of accessing the closed, Transit controlled WAN, both in the maintenance yard and at each bus station along the ART route).

**Please present options and pricing for each:**

- **System with Ad hoc messages and real-time travel and location information on a map and at least two (2) LCD screens 15 inches or larger.**
- **System displaying agency information about upcoming events and service changes updated wirelessly to be displayed by two (2) LCD screens 15 inches or larger.**
- **System displaying advertising to passengers in addition to Ad hoc messages, real-time travel and location information on a map and at least two (2) LCD screens 15 inches or larger.**
- **Pricing to include both initial capital purchase price as well as any annual cost for subscriptions or software maintenance**

**TSE 83. Passenger Stop Request/Exit Signal****Pull Cord Passenger Signal**

A passenger "stop requested" signal system that complies with applicable ADA requirements defined in 49 CFR, Part 38.37 shall be provided. The system shall consist of a heavy-duty pull cable, chime and interior sign message. The pull cable shall be located the full length of the bus on the sidewalls at the level where the transom is located. If no transom window is required, the height of the pull cable shall approximate this transom level and shall be no greater than 63 in. as measured from the floor surface. It shall be easily accessible to all passengers, seated or standing. Pull cable(s) shall activate one or more solid state or magnetic proximity switches. At each wheelchair passenger position and at priority seating positions, additional provisions shall be included to allow a passenger in a mobility aid to easily activate the "stop requested" signal.

Auxiliary passenger "stop requested" signals shall be installed at the center and rear doors on both sides to provide passengers standing in the rear door/exit area convenient means of activating the signal system. The signal shall be a heavy-duty push button type located in the rear door vicinity. Button shall be clearly identified as "passenger signal."

No requirements for additional "stop request" button on rear door stanchion.

A single "stop requested" chime shall sound when the system is first activated. A double chime shall sound anytime the system is activated from wheelchair passenger areas.

Exit signals located in the wheelchair passenger area shall be no higher than 4 feet above the floor. Instructions shall be provided to clearly indicate function and operation of these signals.

City to specify the stop request system for wheelchair seating area.

**TSE 84. Communications****TSE 84.1 Camera Surveillance System**

Provide all wiring and mounting locations for a multi-camera surveillance system including the installation of cameras, recorder, microphone, etc.

**Camera System Specifications:**

Two Seon DX-HD digital video recorders (DVRs), associated equipment and accessories or approved equal shall be installed on each bus. One of the DVRs (DVR1) shall be connected to all exterior viewing cameras. The second of the two DVRs (DVR2) shall be connected to all interior viewing cameras (see camera placement diagram).

The two DVRs shall have an integrated and internally built in inertia sensors. The inertia sensors shall record movements in forward, backward, left, right, vertical up and vertical down directions.

Each DVR shall have two removable hard disk drives that are mounted in one cassette. Each of the two hard disk drives shall be a minimum of 1TB in size, providing a total of 2TB of recording space. If one of the two hard disk drives fails, the other will continue to function with its own recording space of 1TB.

Each DVRs shall have the ability to accept video feeds from a minimum of 12 total channels with audio and 1 high-definition channel. The DVR shall have the ability to record 30 frames per

second on all 13 channels.

Each DVR shall have the ability to accept GPS signals to calculate the vehicle's latitude and longitude. Each DVR shall also have the ability to automatically adjust its internal clock from GPS signals.

Each DVR shall have the ability to digitally save and load its entire configuration from a USB storage device.

Each DVR shall have the ability to record and replay in dual stream. Each stream of video shall be configurable. The lower quality stream shall be used for fast viewing over data cellular connectivity or slower data connection methods. The higher quality stream shall be used for clarity of images and higher data connection methods.

Each DVR shall the ability to record 12 independent audio tracks.

Each DVR shall have a minimum of three Ethernet RJ45 ports and two USB ports. Offloading of video and audio can be performed by connecting a USB data storage device to the DVR.

All cameras shall have automatic and integrated infrared emitters for low-light or zero-light conditions.

All interior dome cameras shall have integrated audio recording capabilities.

<b><u>Part ID or Approved Equal</u></b>	<b><u>Description</u></b>	<b><u>Qty Per Bus</u></b>
DXHDNH2T0	DXHD DVR with 20' Power harness, 2x1TB HDD, NO BP	2
WPO0AG4	Smart-Link Bundle W/DIA/SIG/H4/GPS4	2
CA904EI20	CA904EI Camera with 20ft Cable Harness	3
CA904EI50	CA904EI Camera with 50ft Cable Harness	3
CA904EI75	CA904EI Camera with 75ft Cable Harness	1
CQ903A20	CQ903A Camera with 20ft Cable Harness	3
CQ903A50	CQ903A Camera with 50ft Cable Harness	3
CQ903A75	CQ903A Camera with 50ft Cable Harness	3
CHW702EJ20	CHW702E Camera with 20ft Cable Harness & PPOE	1
CA-MP6	Assembly, CHW/CA Camera 6" Mounting Post	1
DXHD-HK2T0	Assembly, Service Package, DXHD 2x1TB HDD	2

#### **Vehicle Data Recorded as Signal Inputs**

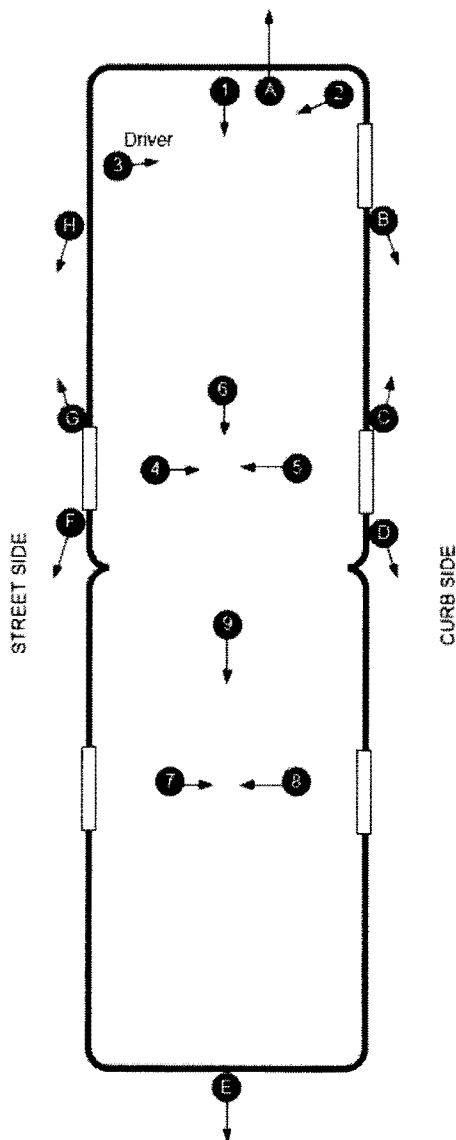
Signal inputs shall be connected to DVR2

Left turn signal

Right turn signal

Brakes applied

Bus stop requested / wheelchair lift requested

**Camera Location Diagram and DVR Use**

DVR1	DVR2
A Traffic in front and traffic control signals	1 Center of bus aisle view CQ903A20
B Loading/exit area at center door	2 Driver with as much view of the driver's face and hands as possible CQ903A20
C Loading/exit area at front door	3 Front entry door and activity near fare box CQ903A20
D Loading/exit area at rear door	4 Center curb side door CQ903A50
E Approaching traffic coming toward rear of bus	5 Center street side door CQ903A50
F Loading/exit area at rear door	6 Center aisle of bus and surrounding seats CQ903A50
G Traffic near front right corner of bus	7 Rear curb side door CQ903A75
H Loading/exit area at center door	8 Rear street side door CQ903A75
	9 Rear seating area CQ903A75

**TSE 84.2.1 Public Address System****ADA Announcement System**

A Digital Recorders DR700 Talking Bus® stop announcement system or approved equal shall be installed on each vehicle. The system shall meet or exceed all ADA requirements found in 49CFR Parts 37.167 and 38.35 and shall provide different, simultaneous audio announcements to riders on-board and waiting curbside. The system shall also provide a control capability for integrating present and future electronics on the bus. In order to maximize the system's useful life and to ensure ease of integration with third party electronics on transit vehicles, the system shall provide a robust, open software and hardware architecture. The system shall comply with SAE J1587/J1939 vehicle communications protocols. The system shall have the capability of hardware and software extension to include new or additional features. The system shall also incorporate ease of programming and updates of all operating information.

### **Automatic Voice Annunciator System (AVAS)**

The DR700, or approved equal, stop announcement system shall be capable of providing a single log-on for other in-vehicle electronics systems (e.g.; destination / head signs systems, fare collection systems, automatic passenger counters, etc.). The communications protocol to accomplish system integration shall be SAE J1587/J1939 or DRSIP. The system shall include an easy-to-use means of specifying whether log-on and/or passwords are required, and what vehicle operator ID's and passwords are acceptable for each sub-system.

The system shall allow the operator to select the route and shall display the route and the next stop to be announced on the operator control unit. The operator shall have the ability to scroll forward or backward within the selected route's list of announcements. Internal announcements are intended for on-board riders and shall play either by manual activation by the operator or in response to signals received by an on-board Automatic Message Trigger (AMT). The Automatic Message Trigger function shall incorporate a Global Positioning System (GPS) receiver with WAAS and dead-reckoning augmentations. External announcements shall play automatically when the door is opened for a stop.

The system shall also provide the ability to define and play up to 99 special announcements and 200 announcements which play at pre-defined times of day, depending upon the amount of memory available. The system shall provide the ability to play external announcements on a repeating "loop" at regular time intervals until canceled by the operator.

The system shall provide an easy-to-use means of updating the programmed database in the in-vehicle stop announcement system's vehicle logic unit with a USB data key and by connection to a local area network though a wireless network connection.

The DR700, or approved equal, stop announcement system shall have dual channel audio capable of playing simultaneous internal and external announcements. Vendor shall provide all database programming and route mapping services necessary for the system to be fully functional.

The system shall include a noise-sensing function. An Automatic Volume Control (AVC) system with three sensing inputs shall automatically and independently adjust each channel's audio volume as appropriate in response to ambient noise detected.

### **Operator Control Unit**

The LT2 Operator Control Unit (OCU), in conjunction with the VLU, shall provide a single operator log-on for electronic devices on the transit vehicles, at the Authority's discretion. The OCU shall provide a display and keypad which are specifically adapted for transit operations. The LT2 OCU shall have the functionality to update both the destination signs and the voice annunciation system. Any programming changes for either the destination signs and/or the voice annunciation system can be written to a single USB Key and that one key used to update both systems through the Vehicle Logic Unit. The OCU shall be easily located within the vehicle operator area; operate under a wide temperature range (-20°C to +70°C) and have dedicated keys for functions such as:

- Safety/Regulatory Announcements
- Route A/Route B selection
- Repeat Last Announcement
- Loop External Announcement



- Increase/decrease display screen's brightness
- Arrow keys for scrolling forward or backward
- Activate Internal Announcements
- P/R Button
- Mic. Volume button
- Menu button

The OCU Unit shall contain a display of at least two-lines of 20-character capability. The OCU Unit shall contain an audio speaker that beeps indicating that a key is depressed.

The OCU enclosure shall be constructed of rugged aluminum housing and meet FCC Part 15 for shielding of EMI/RFI. The OCU keypad shall have a minimum of 28 keys within a sealed, elastomeric membrane. An audible beep shall sound when keys are activated. A warning beep shall sound to indicate incorrect key selection.

### **Type-N Operator Control Unit**

The Type-N Operator Control Unit (OCU), in conjunction with the VLU, shall provide a single operator log-on for electronic devices on the transit vehicles, at the authority's discretion.

The MDT shall provide a display and keypad which are specifically adapted for transit operations. The Type-N shall have the functionality to control both the destination signs and the voice annunciation system.

The graphical display of the MDT shall allow for a variety of fonts with multiple lines of text and up to 40 characters per line. The MDT shall also contain an audio annunciator that beeps indicating that a key is depressed. A warning beep sounds to indicate incorrect key selection. The MDT keypad shall have 18 keys within a sealed, electrometric membrane and a rotary dial with a push to select function. The MDT enclosure shall be constructed using a rugged housing and meet FCC Part 15 for shielding of EMI/RFI.

It shall be possible to configure the MDT to work as an AVAS MDT only device, or to interwork with the DR AVL2 system.

### **Vehicle Logic Unit**

The DR700 VLU, or approved equal, shall provide the hardware and software necessary to:

- Provide a single-point operator login for connected equipment
- Coordinate audio announcements and sign displays
- Accept data generated by the Route Mapping Module (RMM) and Central Recording Station (CRS) database software applications or their equivalents
- Off-load data and accept updates via USB data Key and/or 802.11x WLAN
- Integrate with Digital Recorders' Type LT2, Type N, and Type Q Operator Control Units, or their equivalents
- Integrate with internal LED signs for internal announcements
- Interface with J1587/J1939 engine controllers, transmissions, and other onboard devices
- Allow for future hardware and software expansion
- Support Wireless Data Transfer for software, configuration, announcement data, and route data updates

- Supports all features and functions associated with the Digital Recorders AVL2 automatic vehicle location system, or its equivalent

At a minimum, the VLU shall have the following hardware and characteristics:

- Overall size 8.50" long, 8.38" wide, and 3.87" high
- 4 audio outputs, 25W each (2 internal, 1 external, 1 driver monitor speaker)
- 2 Ambient Sensing Inputs
- 16 discrete inputs
- 3 discrete outputs
- 2 x SAE J1708
- 2 x SAE J1939 (CAN 250K)
- 5 x RS232
- 2 x RS485
- 4 x USB
- Integrated 20-channel GPS with dead-reckoning
- 4 x RJ45 Ethernet
- Integrated Wi-Fi capability supporting IEEE 802.11a, b, g, n
- Positive-locking, heavy-duty connectors
- Hardware & software feature expansion
- Built-in real-time clock
- Compliance with DRSIP communications protocol

### **Internal Display Sign**

The internal display sign shall display coordinating text for next stop and other audio announcements. The sign shall meet all ADA requirements for internal signage. The sign shall be a Light Emitting Diode (LED) type sign with 16 characters per line with bright amber LEDs. Sign shall be no larger than 27" x 2 1/8" x 4 1/8" (single line) or 6 1/8" (double line). The sign shall be programmable via the DR700 CRS or its equivalent. Messages can be shown streaming or by any of 3 single frame modes with automatic centering. Speed, delays, and looping shall be programmable. Busy/ready status shall be poll-able. Forced reset capability shall exist.

The internal LED display sign shall be used to display the words "Stop Requested" and shall be visible to passengers when the passenger chime is activated and shall remain on until the front or rear door is opened. The internal LED display sign shall also be used to display "Lift Requested" when the passenger chime is activated provided there are separate outputs on the vehicle to designate different chimes for Stop Requested and Lift Requested.

Enclosure shall be aluminum with welded and sanded seams, black powder paint finish and acrylic fascia with matte finish for reduction of reflected glare. The sign shall be constructed to withstand the harsh environmental conditions found in transit applications. One shall be installed at the front of the bus, with the second at the front of the rear section of the bus.

### **Audio Diagnostics**

The Stop Announcement vehicle logic unit shall be capable of playing audio diagnostics for all currently integrated electronics and capability for electronics which may be integrated in the future. This includes diagnostics for the destination sign system, internal passenger information signs, Operator Control Unit, internal speaker system, external speaker system, navigation

system, and vehicle maintenance devices. The VLU shall confirm proper communications with each of these devices, log results, and provide audio messages describing any failures.

### **Wireless Data Transfer**

The vehicles shall be equipped with Digital Recorders a DR700 with integrated Wi-Fi capability or equivalent. The Wireless Data Transfer System shall include vehicle hardware, base station hardware, and software for wireless transfer of data between a centralized base station and individual fleet vehicles. With the exception of the antenna, the on-vehicle hardware shall be internal to the DR700 or its equivalent. Data shall be transmitted using an industry-standard 802.11 a/b/g/n system with security enhancements-

Data network shall include WPA and WPA2 encryption and authentication. The wireless technology shall not require the transit authority to obtain a transmission license. The system shall communicate in both point-to-point and point-to-multipoint configurations.

The Wireless Data Transfer system shall be bi-directional and shall be used for the purposes of remote data collection from vehicle systems such as APC and AVM and/or for on-vehicle software and data updates.

The system shall permit date-specific deployment of changes and incremental updates (e.g., the system shall transmit only the voice announcements, destination sign text, route and schedule changes, etc. that have changed.) The wireless server software shall be configurable to determine frequency of data transmission and types of data transferred. The software shall make it possible to specify a future time and date for an update to become active.

The system shall allow automatic data transfer initiation (when the vehicle is in range of the base station) and requires no operator interaction.

Data collected from the vehicles shall be clearly labeled at the base station, and the software shall permit sorting/filtering/searching of parameters. Pre-configured, standard reporting options shall be available within the software package itself, and the data may be exported in industry standard delimited formats for external use and specific software applications.

#### **TSE 84.2.1.1 Speakers**

The DR-VLU stop announcement system or its equivalent shall utilize 4-6 4 ohm speakers for internal announcements. Internal speakers shall have a range of 70 - 15,000 Hz at a minimum. The external speaker(s) shall be a weatherproof; horn-type constructed of a hard plastic or aluminum material and have a minimum range of 200 - 15,000 Hz.

All internal and external speaker locations shall require prior approval by the Authority.

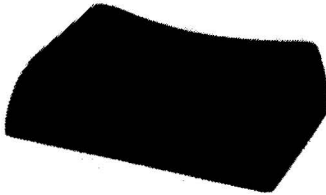
#### **TSE 84.3 Wireless Mobile Router/Cellular Modem**

One Sierra Wireless GX440 or approved equal shall be installed on each bus. The GX440 shall include the WiFi option and additional Ethernet ports option. The GX440 does not require the I/O option.

Each bus shall have a Sierra Wireless or approved equal antenna mounted on the roof with appropriate cellular, WiFi and GPS wiring to each GX440. This antenna shall have 8" square aluminum grounding plane. Antenna and grounding plane shall be sealed to prevent water leaks.

The GX440 shall be mounted inside of the electronics cabinet of the bus. The mounting shall provide easy access to cable connections and well as visibility of status lights of the GX440.

Network Systems > Broadband Radios > Cellular Gateways/ Routers/Automation > Cellular Modems > SKU# 577475



### Sierra Wireless - AirLink GX440 LTE Cell Modem-Verizon,DC,GPS, WiFi

TESSCO SKU : 577475 Mfg Part #: 1101531 Qty/UOM : 1 EACH UPC: 729198619336

The Sierra Wireless AirLink GX440 cellular gateway for Verizon, offers a small form factor modem with GPS, (1) Ethernet, (1) Serial, and (1) USB functionality. This model supports the Verizon LTE network, and will "fall back" if the LTE network is unavailable. GPS and RF antenna connectivity is available through three SMA plugs and one RPSMA plug. Power is delivered via the included DC wall adapter.

List: \$899.00

Your Price: \$899.00

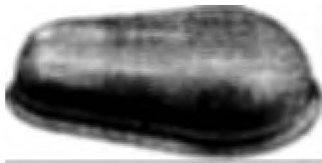
Qty:

Add

The GX440 family of 4G LTE intelligent gateway modems provides a flexible device with multiple interfaces, reliable cellular connectivity and a built-in expansion slot to provide scalability required today's applications. The GX440 is compact, has a rugged design and an advanced GPS which makes this cellular modem a powerful solution, at an affordable price.

Designed for versatility with embedded intelligence, the AirLink GX440 offers many configurations and has a variety of interfaces to suit a wide range applications. Applications include transportation, industrial machine-to-machine (M2M), and enterprise applications.

Mobile Devices & Accessories > Mobile Antennas & Amplifiers > Mobile Antennas > Dual/Multi Band Antennas > SKU# 503963



### Antenna Plus - AP-MIMO LTE/Cellular/PCS/GPS/WiFi Combo Antenna

TESSCO SKU : 503963 Mfg Part #: APCCWQGS2222RP3WH Qty/UOM : 1 EACH UPC: 729198162252

SIERRA WIRELESS AP-MIMO LTE/Cellular/ PCS/GPS/WIFI Combo antenna, Thread Bolt Mini, Omni 3dB(Cell/WIFI) 30dB(GPS), (2) SMA M (Cell), SMA M(GPS), RP SMA M(WIFI), White.

List: \$199.00

Your Price: \$199.00

Qty:

Add

### TSE 84.4 Electronics Cabinet Constant Power, Ignition Power and Chassis Ground

The electronics cabinet (EC) shall be located directly behind the driver and on top of the street side front wheel well. The EC shall be water resistant design to prevent water damage from routine bus cleaning. The EC shall have a single wide opening door for ease of access to the interior. The EC's door shall have two square keyed latches. The EC's door shall be a left handed door (hinged at the rear of the cabinet).

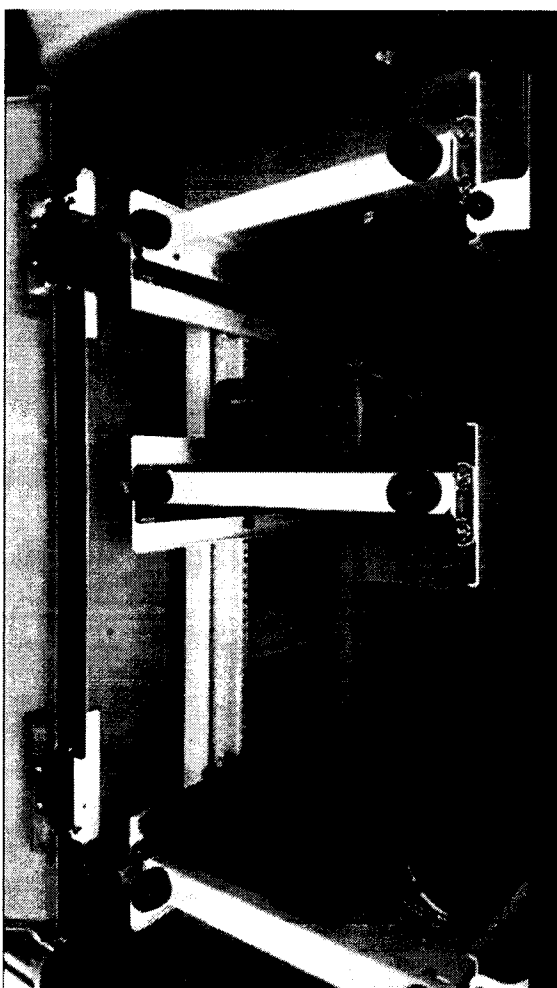
The interior of the EC shall have three trays that is able to slide out. These slides shall be of roller bearing construction and shall also have latches to hold them in the closed or stowed position. Each tray shall have two rubber stoppers facing the EC's door. The surface area of each sliding tray shall be 15" wide by 20" deep. All trays shall have rounded edges to prevent wires from chafing. The mounting enclosure for these trays shall have multiple mounting holes so that trays may be repositioned higher or lower. The first tray shall be mounted near the top of the enclosure. The second tray shall be mounted mid-point. The last tray shall be mounted near the bottom of the enclosure.

The street side of the EC shall be accessible from the outside of the vehicle.





Location of the electronics cabinet



Interior view of electronics cabinet

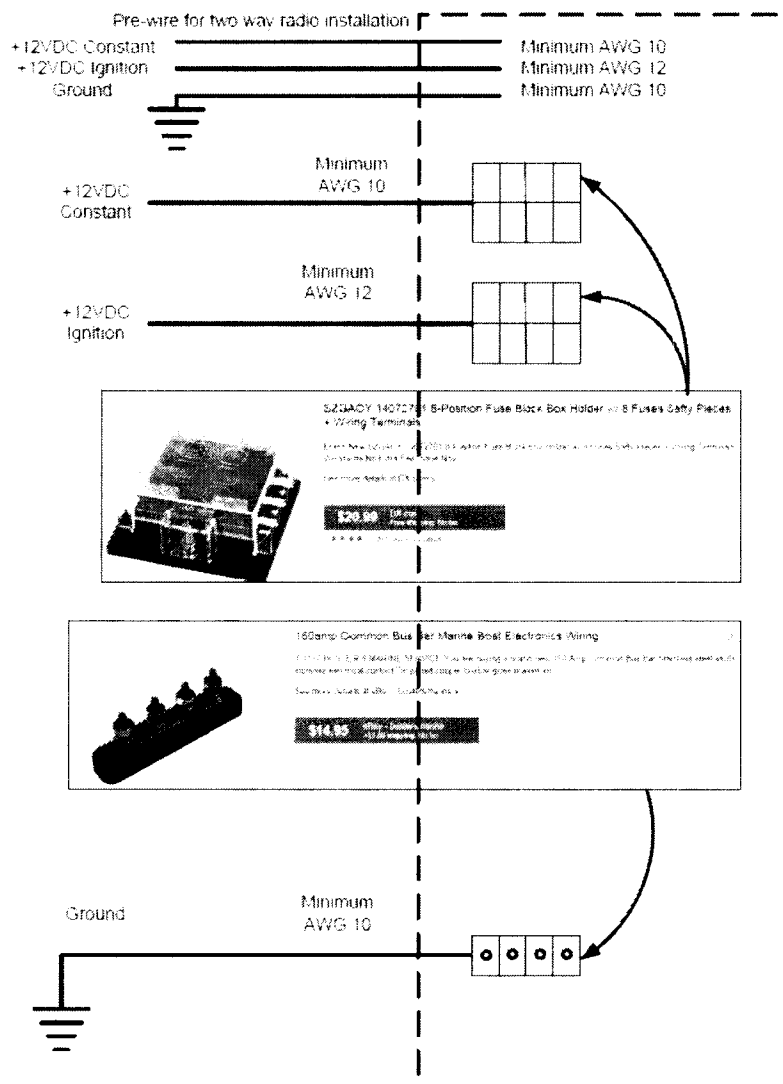


Wiring for the two way radio: the wiring shall be installed by the successful Offeror, the equipment will be installed by the City of Albuquerque.

- One 10 gauge +12VDC constant
- One 12 gauge +12VDC ignition
- One 10 gauge ground
- A six (six) foot coil of each wire should be left at each termination point

Wiring for IT equipment:

- One 10 gauge +12VDC constant connected to fuse block
- One 12 gauge +12VDC ignition connected to fuse block
- One 10 gauge ground connected to bus bar



### TSE 84.5 Automatic Passenger Counter (APC)

The APC system selected shall have an accuracy rating (comparing the accuracy of the APC to manual counts) of at least 95%, and have been approved by the FTA for NTD reporting in at least

one other jurisdiction.

Each bus shall come equipped with sensors at each door, capable of determining the direction of travel of the passenger (onto the bus or off of the bus). The system shall include whatever data consolidation equipment is required to consolidate the data prior to its transmission to a back end system which will make the data available for reporting. Each APC system will be capable of uploading its data wirelessly to that back end system analyzer or reporting system.

The on-board APC system shall integrate with the electronics and data communications system of the bus so as to use the existing wiring systems of the bus to sense trigger conditions, such as the door open status.

It is preferred that the APC system integrate with whatever GPS and cellular communications devices that are accommodated by equipment required elsewhere in these specifications, specifically the Sierra Wireless GX440.

The vendor supplying the APC system shall provide a warranty covering the equipment installed.

The vendor supplying the APC system shall provide the software required to analyze and report on the data of the on-board equipment, provided that software can be installed on a virtual server. In the event the software cannot be housed on a virtual server, the vendor will also supply any required hardware to serve as the server for this purpose.

The vendor supplying the APC system shall provide a support and maintenance agreement covering items such as firmware updates, phone call and e-mail support, and software upgrades for the software required to configure and manage that reporting and analyzing system. The support agreement will provide for a service level agreement requiring response (can be local or remote) within 48 hours of the notice of outage (e-mail or phone call)

The vendor supplying the APC shall provide onsite training for up to 10 ABQ Ride staff and include topics regarding the installation and configuration of the hardware and software required to configure and manage the APC system.

APCs will need to be installed on all doors.

**Please present options and the pricing for APC's.**

#### **TSE 84.6 Radio Handset and Control System**

Each bus shall have the following and shall be supplied to the City of Albuquerque. The City of Albuquerque will be responsible for the installation of the equipment; the Contractor shall install the wiring. Recommended vendor is Daily-Wells Communications, Inc. Contact person is Richard Kirian at 505-453-2029. Delivery address is 1801 4<sup>th</sup> Street NW, Albuquerque, NM 87102 Attn: Renae Jarvies ART Buses.

Qty	Part Number	Description
1	MAHK-S8MEX	Harris M5300 Radio 800 Mhz Trunked/EDACS
1	HK-PL4U	Feature, Single-Key DES Encryption
1	MAHK-NPL7Z	Feature, 512 Systems/Groups

1	MAHK-NCP9E	Control Unit, CH721 Remote Mount
1	MAHK-NZN7R	Accessories, M5300 Remote Mount
1	MAHK-NMC7Z	Microphone, Standard, CH721 Control Unit
1	MACDOS0012	Head Mounting Pedestal

Each bus shall have the following and shall be supplied to the City of Albuquerque. The City of Albuquerque will be responsible for the installation. Recommended vendor is Telephone Components. Same shipping address as above.

Qty	Part Number	Description
1	TG-419X1012	Transit Telephone Style Handset

The entire bus order shall have the following supplied to the City of Albuquerque. Recommended vendor is Tescos. Contact person is Joshua Hamlet at 800-472-8063. Same shipping address as above.

Qty	SKU#	Part Number	Description
2	74227	RFT-1202-2	25 Pk TNC Male Crimp-RG58-141
2	26367	RFN-1005-3C	25 Pk N Male Crimp-RG58-RG141
30	35012	ASP931	806-894 Low Silhouette
3	469004	469004	10 Pk Mini-ATM Fuse Plug
1	36028	RF195-1000	RG58 1000ft Coaxial Cable
3	380840	FH1012-GM/10Pack	ATC Premium Fuse Holder

The entire bus order shall have the following supplied to the City of Albuquerque. Recommended vendor is DigiKey. Same shipping address as above.

Qty	Part Number	Description
30	A32505-ND	DB25 Solder Type Male Connector
60	A33667-ND	DB25 Hood
30	A32508-ND	DB25 Solder Type Female Connector
30	A1410-ND	TE Connectivity 1-480319-0 Receptacle 2pin Mate-n-Lok
30	A1411-ND	TE Connectivity 1-480318-0 Plug 2pin Mate-n-Lok
60	A97888TR-ND	TE Connectivity 61114-1 Conn Socket Mate-n-Lok
60	A97887TR-ND	TE Connectivity 61118-1 Pin Mate-n-Lok
120	952-2314-ND	Standoff DB25 to DB25 Connector

#### **TSE 84.7 On-board Traffic Signal Prioritization (TSP)**

The on-board TSP system shall have the capability to automatically initiate requests for priority at signalized intersection based on the following factors:

- User-specified distance from the signalized intersection.
- Optionally, user-specified number of seconds from the signalized intersection based on vehicle speed and projected arrival time at signalized intersection.

- Conditional priority for signalized intersections where vehicles running behind schedule, based on user-specified threshold for the number of minutes late at the last schedule time point passed by the transit vehicle.
- Ideally, that conditional priority will be based on existing sources of schedule data and GPS coordinates of the bus
- Deactivation of the emitter when the system senses that the door of the bus is open.

The on-board TSP system shall integrate with the electronics and data communications system of the bus so as to use the existing wiring systems of the bus to sense trigger conditions, such as the door open status.

It is preferred that the TSP system integrate with whatever GPS and cellular communications devices that are accommodated by equipment required elsewhere in these specifications, specifically the Sierra Wireless GX440.

The vendor supplying the TSP system shall provide a warranty covering the equipment installed.

The vendor supplying the TSP system shall provide the software required to manage the on-board equipment and the on-street signal light equipment, provided that software can be installed on a virtual server. In the event the software cannot be housed on a virtual server, the vendor will also supply any required hardware to serve as the server for this purpose.

The vendor supplying the TSP system shall provide a support and maintenance agreement covering items such as firmware updates, phone call and e-mail support, and software upgrades for the software required to configure and manage the on-board and on-street equipment. The support agreement will provide for a service level agreement requiring response (can be local or remote) within 48 hours of the notice of outage (e-mail or phone call)

The vendor supplying the TSP shall provide onsite training for up to 10 ABQ Ride staff and include topics regarding the installation and configuration of the software required to configure and manage the TSP system.

**Please provide options and pricing for systems meeting the above requirements.**

#### **TSE 84.8 VIBs**

Install and connect VIBs compatible for communication with Asset Works Fuel Focus.

## SECTION 3.5

### WR 1. Basic Provisions

#### WR 1.1 Warranty Requirements

##### WR 1.1.1 Successful Offeror Warranty

Warranties required in this RFP are in addition to any statutory remedies or warranties imposed on the successful Offeror. Consistent with this requirement, the successful Offeror warrants and guarantees to the City each complete bus and specific subsystems and components as follows. Performance requirements based on design criteria shall not be deemed a warranty item.

##### WR 1.1.2 Complete Bus

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

##### WR 1.1.3 Body and Chassis Structure

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

Primary load-carrying members of the bus structure, including structural elements of the suspension, are warranted against corrosion failure and/or Fatigue Failure sufficient to cause a Class 1 or Class 2 Failure for a period of 12 years or 500,000 miles, whichever comes first. Class 1 Failure (physical safety) is a failure that could lead directly to passenger or operator injury and represents a severe crash situation. Class 2 Failure (road call) is a failure resulting in an en route interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

##### WR 1.1.4 Propulsion System

Propulsion system components, specifically the engine, transmission or drive motors, and drive and non-drive axles shall be warranted to be free from Defects and Related Defects for the standard two years or 100,000 miles, whichever comes first.

##### WR 1.1.5 Emission Control System (ECS)

The successful Offeror warrants the emission control system for five years or 100,000 miles, whichever comes first. The ECS shall include, but is not limited to, the following components:

- complete exhaust system, including catalytic converter (if required)
- after-treatment device
- components identified as emission control devices

##### WR 1.1.6 Subsystems

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

Brake system: Foundation brake components, including advancing mechanisms, as supplied with the axles, excluding friction surfaces.

Destination signs: All destination sign equipment for the front, side and rear signs, power modules and operator control.



Heating, ventilating: Roof and/or rear main unit only, excluding floor heaters and front defroster.  
AC unit and compressor: Roof and/or rear main unit only, excluding floor heaters and front defroster.  
Door systems: Door operating actuators and linkages.  
Air compressor  
Air dryer  
Wheelchair lift and ramp system: Lift and/or ramp parts and mechanical only  
Starter  
Alternator: Alternator only. Does not include the drive system.  
Charge air cooler: Charge air cooler including core, tanks and including related surrounding framework and fittings.  
Fire suppression: Fire suppression system including tank and extinguishing agent dispensing system  
Hydraulic systems: Including radiator fan drive and power steering as applicable.  
Engine cooling systems: Radiator including core, tanks and related framework, including surge tank.  
Transmission cooler  
Passenger seating excluding upholstery  
Fuel storage and delivery system  
Surveillance system including cameras and video recorders

#### **WR 1.1.7 Serial Numbers**

Upon delivery of each bus, the successful Offeror shall provide a complete electronic list of serialized units installed on each bus to facilitate warranty tracking. The list shall include, but is not limited to:

- engine
- transmission
- alternator
- starter
- A/C compressor and condenser/evaporator unit
- drive axle
- power steering unit
- fuel cylinders (if applicable)
- air compressor
- wheelchair ramp (if applicable)

The successful Offeror shall provide updated serial numbers resulting from warranty campaigns. The format of the list shall be approved by the City prior to delivery of the first production bus.

#### **WR 1.1.8 Extension of Warranty**

If, during the warranty period, repairs or modifications on any bus are made necessary by defective design, materials or workmanship but are not completed due to lack of material or inability to provide the proper repair for thirty (30) calendar days, the applicable warranty period shall be extended by the number of days equal to the delay period.

#### **WR 1.2 Voiding of Warranty**

The warranty shall not apply to the failure of any part or component of the bus that directly results from misuse, negligence, accident or repairs not conducted in accordance with the successful Offeror-provided maintenance manuals and with workmanship performed by adequately trained personnel in accordance with recognized standards of the industry. The warranty also shall be void if the City fails to conduct normal

inspections and scheduled preventive maintenance procedures as recommended in the successful Offeror's maintenance manuals and if that omission caused the part or component failure. The City shall maintain documentation, auditable by the successful Offeror, verifying service activities in conformance with the successful Offeror's maintenance manuals.

### **WR 1.3 Exceptions and Additions to Warranty**

The warranty shall not apply to the following items:

- scheduled maintenance items
- normal wear-out items
- items furnished by the City

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

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

#### **WR 1.3.1 Pass-Through Warranty**

Should the successful Offeror elect to not administer warranty claims on certain components and wish to transfer this responsibility to the sub-Suppliers, or to others, the successful Offeror shall request this waiver.

The successful Offeror shall state in writing that the City's warranty reimbursements will not be impacted. The successful Offeror also shall state in writing any exceptions and reimbursement including all costs incurred in transport of vehicles and/or components. At any time during the warranty period, the successful Offeror may request approval from the City to assign its warranty obligations to others, but only on a case-by-case basis approved in writing by the City. Otherwise, the successful Offeror shall be solely responsible for the administration of the warranty as specified. Warranty administration by others does not eliminate the warranty liability and responsibility of the successful Offeror.

#### **WR 1.3.2 Superior Warranty**

The successful Offeror shall pass on to the City any warranty offered by a component Supplier that is superior to that required herein. The successful Offeror shall provide a list to the City noting the conditions and limitations of the Superior Warranty not later than the start of production. The Superior Warranty shall not be administered by the successful Offeror.

### **WR 1.4 Fleet Defects**

#### **WR 1.4.1 Occurrence and Remedy**

A Fleet Defect is defined as cumulative failures of twenty-five (25) percent of the same components in the same or similar application in a minimum fleet size of twelve (12) or more buses where such items are covered by warranty. A Fleet Defect shall apply only to the base warranty period in sections entitled "Complete Bus," "Propulsion System" and "Major Subsystems." When a Fleet Defect is declared, the remaining warranty on that item/component stops. The warranty period does not restart until the Fleet Defect is corrected.

For the purpose of Fleet Defects, each option order shall be treated as a separate bus fleet. In addition, should there be a change in a major component within either the base order or an option order, the buses containing the new major component shall become a separate bus fleet for the purposes of Fleet Defects.

The successful Offeror shall correct a Fleet Defect under the warranty provisions defined in "Repair Procedures." After correcting the Defect, the City and the successful Offeror shall mutually agree to and the successful Offeror shall promptly undertake and complete a work program reasonably designed to prevent the occurrence of the same Defect in all other buses and spare parts purchased under the Contract resulting from this RFP. 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 successful Offeror shall update, as necessary, technical support information (parts, service and operator's manuals) due to changes resulting from warranty repairs. The City may immediately declare a Defect in design resulting in a safety hazard to be a Fleet Defect. The successful Offeror shall be responsible to furnish, install and replace all defective units.

#### **WR 1.4.2 Exceptions to Fleet Defect Provisions**

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

### **WR 2. Repair Procedures**

#### **WR 2.1 Repair Performance**

The successful Offeror is responsible for all warranty-covered repair Work. To the extent practicable, the City will allow the successful Offeror or its designated representative to perform such Work. At its discretion, the City 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 successful Offeror.

#### **WR 2.2 Repairs by the successful Offeror**

If the City detects a Defect within the warranty periods defined in this section, it shall, within thirty (30) days, notify the successful Offeror's designated representative. The successful Offeror or its designated representative shall, if requested, begin Work on warranty-covered repairs within five calendar days after receiving notification of a Defect from the City. The City shall make the bus available to complete repairs timely with the successful Offeror's repair schedule.

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

#### **WR 2.3 Repairs by the City**

##### **WR 2.3.1 Parts Used**

If the City performs the warranty-covered repairs, it shall correct or repair the Defect and any Related Defects utilizing parts supplied by the successful Offeror specifically for this repair. At its discretion, the City may use successful Offeror-specified parts available from its own stock if deemed in its best interests.

##### **WR 2.3.2 successful Offeror-Supplied Parts**

The City may require that the successful Offeror supply parts for warranty-covered repairs being performed by the City. Those parts may be remanufactured but shall have the same form, fit and function, and warranty. The parts shall be shipped prepaid to the City from any source selected by the successful Offeror within fourteen (14) days of receipt of the request for said parts and shall not be subject to an City handling charge.

**WR 2.3.3 Defective Component Return**

The successful Offeror may request that parts covered by the warranty be returned to the manufacturing plant. The freight costs for this action shall be paid by the successful Offeror. Materials should be returned in accordance with the procedures outlined in "Warranty Processing Procedures."

**WR 2.3.4 Failure Analysis**

The successful Offeror shall, upon specific request of the City, provide a failure analysis of Fleet Defect or safety-related parts, or major components, removed from buses under the terms of the warranty that could affect fleet operation. Such reports shall be delivered within 60 days of the receipt of failed parts.

**WR 2.3.5 Reimbursement for Labor and Other Related Costs**

The City shall be reimbursed by the successful Offeror for labor. The amount shall be determined by the City for a qualified mechanic at a straight time wage rate of Sixty-Five Dollars (\$65) per hour, which includes fringe benefits and overhead adjusted for the City's most recently published rate in effect at the time the Work is performed, plus the cost of towing the bus if such action was necessary and if the bus was in the normal service area. These wage and fringe benefit rates shall not exceed the rates in effect in the City's service garage at the time the Defect correction is made.

**WR 2.3.6 Reimbursement for Parts**

The City shall be reimbursed by the successful Offeror for defective parts and for parts that must be replaced to correct the Defect. The reimbursement shall be at the current price at the time of repair and shall include taxes where applicable, plus fifteen (15) percent handling costs. Handling costs shall not be paid if part is supplied by successful Offeror and shipped to City.

**WR 2.3.7 Reimbursement Requirements**

The successful Offeror shall respond to the warranty claim with an accept/reject decision including necessary failure analysis no later than sixty (60) days after the City submits the claim and defective part(s), when requested. Reimbursement for all accepted claims shall occur no later than sixty (60) days from the date of acceptance of a valid claim. The City may dispute rejected claims or claims for which the successful Offeror did not reimburse the full amount. The parties agree to review disputed warranty claims during the following quarter to reach an equitable decision to permit the disputed claim to be resolved and closed. The parties also agree to review all claims at least once per quarter throughout the entire warranty period to ensure that open claims are being tracked and properly dispositioned.

**WR 2.4 Warranty after Replacement/Repairs**

If any component, unit or subsystem is repaired, rebuilt or replaced by the successful Offeror or by the City with the concurrence of the successful Offeror, the component, unit or subsystem shall have the unexpired warranty period of the original. Repairs shall not be warranted if the successful Offeror-provided or authorized parts are not used for the repair, unless the successful Offeror has failed to respond within five days, in accordance with "Repairs by the successful Offeror."

If an item is declared to be a Fleet Defect, the warranty stops with the declaration of the Fleet Defect. Once the Fleet Defect is corrected, the item(s) shall have three (3) months or remaining time and/or miles of the original warranty, whichever is greater. This remaining warranty period shall begin on the repair/replacement date for corrected items on each bus if the repairs are completed by the successful Offeror or on the date the successful Offeror provides all parts to the City.

#### **WR 2.4.1 Warranty Processing Procedures**

The following list represents requirements by the successful Offeror to the City for processing warranty claims. One failure per bus per claim is allowed.

- bus number and VIN
- total vehicle life mileage at time of repair
- date of failure/repair
- acceptance/in-service date
- successful Offeror part number and description
- component serial number
- description of failure
- all costs associated with each failure/repair (invoices may be required for third-party costs):
  - towing
  - road calls
  - labor
  - materials
  - parts
  - handling
  - troubleshooting time

#### **WR 2.5 Forms**

The City's forms will be accepted by the successful Offeror if all of the above information is included. Electronic submittal may be used if available between the successful Offeror and City.

#### **WR 2.6 Return of Parts**

When returning defective parts to the successful Offeror, the City shall tag each part with the following:

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

#### **WR 2.7 Timeframe**

Each claim must be submitted no more than thirty (30) days from the date of failure and/or repair, whichever is later. All defective parts must be returned to the successful Offeror, when requested, no more than forty-five (45) days from date of repair.

#### **WR 2.8 Reimbursements**

Reimbursements are to be transmitted to the following address.

City of Albuquerque  
ABQ Ride  
8001 Daytona Rd NW  
Albuquerque, NM 87121

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## **SECTION 3.6**

### **QA 1. Successful Offeror's In-Plant Quality Assurance Requirements**

#### **QA 1.1 Quality Assurance Organization**

##### **QA 1.1.1 Organization Establishment**

The successful Offeror shall establish and maintain an effective in-plant quality assurance organization. It shall be a specifically defined organization and should be directly responsible to the successful Offeror's top management.

##### **QA 1.1.2 Control**

The quality assurance organization shall exercise quality control over all phases of production, from initiation of design through manufacture and preparation for delivery. The organization shall also control the quality of supplied articles.

##### **QA 1.1.3 Authority and Responsibility**

The quality assurance organization shall have the authority and responsibility for reliability, quality control, inspection planning, establishment of the quality control system, and acceptance/rejection of materials and manufactured articles in the production of the transit buses.

#### **QA 1.2 Quality Assurance Organization Functions**

##### **QA 1.2.1 Minimum Functions**

The quality assurance organization shall include the following minimum functions:

- **Work instructions:** The quality assurance organization shall verify inspection operation instructions to ascertain that the manufactured product meets all prescribed requirements.
- **Records maintenance:** The quality assurance organization shall maintain and use records and data essential to the effective operation of its program. These records and data shall be available for review by the resident inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.
- **Corrective action:** The quality assurance organization shall detect and promptly ensure correction of any conditions that may result in the production of defective transit buses. These conditions may occur in designs, purchases, manufacture, tests or operations that culminate in defective supplies, services, facilities, technical data or standards.

##### **QA 1.2.2 Basic Standards and Facilities**

The following standards and facilities shall be basic in the quality assurance process:

- **Configuration control:** The successful Offeror shall maintain drawings, assembly procedures, and other documentation that completely describe a qualified bus that meets all of the options and special requirements of this procurement. The quality assurance organization shall verify that each transit bus is manufactured in accordance with these controlled drawings, procedures, and documentation.
- **Measuring and testing facilities:** The successful Offeror shall provide and maintain the necessary gauges and other measuring and testing devices for use by the quality assurance organization to

verify that the buses conform to all specification requirements. These devices shall be calibrated at established periods against certified measurement standards that have known, valid relationships to national standards.

- **Production tooling as media of inspection:** When production jigs, fixtures, tooling masters, templates, patterns, and other devices are used as media of inspection, they shall be proved for accuracy at formally established intervals and adjusted, replaced, or repaired as required to maintain quality.
- **Equipment use by resident inspectors:** The successful Offeror's gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the successful Offeror's personnel shall be made available to operate the devices and to verify their condition and accuracy.

### QA 1.2.3 Maintenance of Control

The successful Offeror shall maintain quality control of purchases:

- **Supplier control:** The successful Offeror shall require that each Supplier maintains a quality control program for the services and supplies that it provides. The successful Offeror's quality assurance organization shall inspect and test materials provided by Suppliers for conformance to specification requirements. Materials that have been inspected, tested, and approved shall be identified as acceptable to the point of use in the manufacturing or assembly processes. Controls shall be established to prevent inadvertent use of nonconforming materials.
- **Purchasing data:** The successful Offeror shall verify that all applicable specification requirements are properly included or referenced in purchase orders of articles to be used on transit buses.

### QA 1.2.4 Manufacturing Control

- **Controlled conditions:** The successful Offeror shall ensure that all basic production operations, as well as all other processing and fabricating, are performed under controlled conditions. Establishment of these controlled conditions shall be based on the documented Work instructions, adequate production equipment and special working environments if necessary.
- **Completed items:** A system for final inspection and test of completed transit buses shall be provided by the quality assurance organization. It shall measure the overall quality of each completed bus.
- **Nonconforming materials:** The quality assurance organization shall monitor the successful Offeror's system for controlling nonconforming materials. The system shall include procedures for identification, segregation and disposition.
- **Statistical techniques:** Statistical analysis, tests and other quality control procedures may be used when appropriate in the quality assurance processes.
- **Inspection status:** A system shall be maintained by the quality assurance organization for identifying the inspection status of components and completed transit buses. Identification may include cards, tags or other normal quality control devices.

### QA 1.2.5 Inspection System

The quality assurance organization shall establish, maintain and periodically audit a fully documented inspection system. The system shall prescribe inspection and test of materials, Work in process and completed articles. As a minimum, it shall include the following controls:

- **Inspection personnel:** Sufficient trained inspectors shall be used to ensure that all materials, components and assemblies are inspected for conformance with the qualified bus design.

- **Inspection records:** Acceptance, rework or rejection identification shall be attached to inspected articles. Articles that have been accepted as a result of approved materials review actions shall be identified. Articles that have been reworked to specified drawing configurations shall not require special identification. Articles rejected as unsuitable or scrap shall be plainly marked and controlled to prevent installation on the bus. Articles that become obsolete as a result of engineering changes or other actions shall be controlled to prevent unauthorized assembly or installation. Unusable articles shall be isolated and then scrapped. Discrepancies noted by the successful Offeror or resident inspectors during assembly shall be entered by the inspection personnel on a record that accompanies the major component, subassembly, assembly, or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures or other conditions that cause articles to be in nonconformity with the requirements of the Contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, then the City shall approve the modification, repair or method of correction to the extent that the Contract specifications are affected.
- **Quality assurance audits:** The quality assurance organization shall establish and maintain a quality control audit program. Records of this program shall be subject to review by the City.

## **QA 2. Inspection**

### **QA 2.1 Inspection Stations**

Inspection stations shall be at the best locations to provide for the Work content and characteristics to be inspected. Stations shall provide the facilities and equipment to inspect structural, electrical, hydraulic and other components and assemblies for compliance with the design requirements.

Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. These locations shall minimally include underbody structure completion, body framing completion, body prior to paint preparation, water test, engine installation completion, underbody dress-up and completion, bus prior to final paint touchup, bus prior to road test and bus final road test completion.

### **QA 2.2 Resident Inspectors**

#### **QA 2.2.1 Resident Inspector's Role**

The City shall be represented at the successful Offeror's plant by resident inspectors, as required by FTA. Resident inspectors may be City employees or outside contractors. The City shall provide the identity of each inspector and shall also identify their level of authority in writing. They shall monitor, in the successful Offeror's plant, the manufacture of transit buses built under the procurement. The presence of these resident inspectors in the plant shall not relieve the successful Offeror of its responsibility to meet all of the requirements of this procurement. The City shall designate a primary resident inspector, whose duties and responsibilities are delineated in "Pre-Production Meetings," "Authority" and "Pre-Delivery Tests," below. successful Offeror and resident inspector relations shall be governed by the New Bus Manufacturing Inspection Guidelines set forth below.

#### **QA 2.2.2 Pre-Production Meetings**

The primary resident inspector may participate in design review and pre-production meetings with the City. At these meetings, the configuration of the buses and the manufacturing processes shall be finalized, and all Contract documentation provided to the inspector.

No less than thirty (30) days prior to the beginning of bus manufacture, the primary resident inspector may meet with the successful Offeror's quality assurance manager and may conduct a pre-production audit meeting. They shall review the inspection procedures and finalize inspection checklists. The resident inspectors may begin monitoring bus construction activities two weeks prior to the start of bus fabrication.

### **QA 2.2.3 Authority**

Records and data maintained by the quality assurance organization shall be available for review by the resident inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.

The successful Offeror's gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the successful Offeror's personnel shall be made available to operate the devices and to verify their condition and accuracy.

Discrepancies noted by the resident inspector during assembly shall be entered by the successful Offeror's inspection personnel on a record that accompanies the major component, subassembly, assembly or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures or other conditions that cause articles to be in nonconformity with the requirements of the Contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, the City 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 successful Offeror's plant for the duration of bus assembly Work under the Contract resulting from this RFP. 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 successful Offeror's quality assurance files related to this procurement. These files shall include drawings, assembly procedures, material standards, parts lists, inspection processing and reports, and records of Defects.

### **QA 2.2.4 Support Provisions**

The successful Offeror shall provide office space for the resident inspectors in close proximity to the final assembly area. This office space shall be equipped with desks, outside and interplant telephones, Internet access, file cabinet and chairs.

### **QA 2.2.5 Compliance with Safety Requirements**

At the time of the Pre-Production meeting, the successful Offeror shall provide all safety and other operational restrictions that govern the successful Offeror's facilities. These issues will be discussed and the parties will agree which rules/restrictions will govern the City's inspector(s) and any other City representatives during the course of the Contract.

## **QA 3. Acceptance Tests**

### **QA 3.1 Responsibility**

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



**QA 3.2 Pre-Delivery Tests**

The successful Offeror shall conduct acceptance tests at its plant on each bus following completion of manufacture and before delivery to the City. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation. The tests shall be conducted and documented in accordance with written test plans approved by the City.

Additional tests may be conducted at the successful Offeror's discretion to ensure that the completed buses have attained the required quality and have met the requirements in Section 6: Technical Specifications. The City may, prior to commencement of production, demand that the successful Offeror demonstrate compliance with any requirement in that section if there is evidence that prior tests have been invalidated by the successful Offeror's change of Supplier or change in manufacturing process. Such demonstration shall be by actual test, or by supplying a report of a previously performed test on similar or like components and configuration. Any additional testing shall be recorded on appropriate test forms provided by the successful Offeror and shall be conducted before acceptance of the bus.

The pre-delivery tests shall be scheduled and conducted with thirty (30) days notice so that they may be witnessed by the resident inspectors, who may accept or reject the results of the tests. The results of pre-delivery tests, and any other tests, shall be filed with the assembly inspection records for each bus. The underfloor equipment shall be available for inspection by the resident inspectors, using a pit or bus hoist provided by the successful Offeror. A hoist, scaffold or elevated platform shall be provided by the successful Offeror to easily and safely inspect bus roofs. Delivery of each bus shall require written authorization of the primary resident inspector. Authorization forms for the release of each bus for delivery shall be provided by the successful Offeror. An executed copy of the authorization shall accompany the delivery of each bus.

**QA 3.2.1 Visual and Measured Inspections**

Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing includes verification of overall dimension and weight requirements, that required components are included and are ready for operation, and that components and subsystems designed to operate with the bus in a static condition do function as designed.

**QA 3.2.2 Total Bus Operation**

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion.

Each bus shall be driven for a minimum of fifteen (15) miles during the road tests. If requested, computerized diagnostic printouts showing the performance of each bus shall be produced and provided to the City. Observed Defects shall be recorded on the test forms. The bus shall be retested when Defects are corrected and adjustments are made. This process shall continue until Defects or required adjustments are no longer detected.



## **NEW BUS MANUFACTURING INSPECTION GUIDELINES**

### **Pre-production meeting**

#### **Responsibilities**

##### **City**

- Provides conformed copy of technical requirements.
- Recommended staff to be involved may include the following:
  - Project manager
  - Technical engineer
  - Contract administrator
  - Quality assurance administrator
  - Warranty administrator
- Process for inspector's role (to deal with City) for negotiated changes after freeze date.
- Contractual requirements:
  - Milestones
  - Documentation
  - Title requirements
  - Deliverables
  - Payments
  - Reliability tracking

##### **Manufacturer**

- Identifies any open issues.
- Recommended staff to be involved may include the following:
  - Project manager
  - Technical engineer(s)
  - Contract administrator
  - Quality assurance administrator
  - Warranty administrator
- Production flow (buses/week, shifts).
- Delivery schedule and offsite component build-up schedule.
- Bus QA documentation (including supplier application approvals and/or any certifications required for the specific production).
- Communication flow/decision making.

##### **Inspector**

- Agree on decisions inspectors can and cannot make.
- Primary contact for problems, etc.
- Production flow process (description of manufacturing by station).
- Factory hours (manage inspection schedule based on production hours).
- Plant rules.
- Safety requirements.
- Orientation requirements.
- Work environment.
- Inspector's office space (per contract).

**NOTE:** As a result of this meeting, documentation should be produced detailing final production requirements and the planned configuration of the bus.

### **Build schedule**

The bus manufacturer's contract administrator shall supply a fleet build production schedule based on the dates in the Notice to Proceed, and a description of the manufacturer's schedule for plant operations.

The production schedule should contain specific milestone dates, such as:

- First vehicle on production line (date on which any work will begin);
- First vehicle off production line;
- First vehicle through manufacturer's quality assurance inspections;
- First vehicle shipped to the City;
- Last vehicle on production line;
- Last vehicle off production line; and
- Last vehicle shipped to the City.

### **Plant tour (if meeting at OEM's location)**

The City will review the entire process from start to finish and review the work completed at each line station, including quality control measures

### **Prototype/pilot vehicle production**

The contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture and before delivery to the City. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation. The tests shall be conducted and documented in accordance with written test plans approved by the City. The underfloor equipment shall be available for inspection by the resident inspectors, using a pit or bus hoist provided by the contractor. A hoist, scaffold or elevated platform shall be provided by the contractor to easily and safely inspect bus roofs. Delivery of each bus shall require written authorization of the primary resident inspector. Authorization forms for the release of each bus for delivery shall be provided by the contractor. An executed copy of the authorization shall accompany the delivery of each bus.

Additional tests may be conducted at the City's discretion to ensure that the completed buses have attained the required quality and have met the requirements in the APTA "Standard Bus Procurement Guidelines RFP," Section 6: Technical Specifications. The City may, prior to commencement of production, demand that the contractor demonstrate compliance with any requirement in that section if there is evidence that prior tests have been invalidated by the contractor's change of supplier or change in manufacturing process. Such demonstration shall be by actual test, or by supplying a report of a previously performed test on similar or like components and configuration. Any additional testing shall be recorded on appropriate test forms provided by the contractor and shall be conducted before acceptance of the bus.

The pre-delivery tests shall be scheduled and conducted with 30 days' notice so that they may be witnessed by the resident inspectors, who may accept or reject the results of the tests. The results of pre-delivery tests, and any other tests, shall be filed with the assembly inspection records for each bus.

### **Visual and measured inspections**

Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing includes verification of overall dimension and weight requirements, that required components are included and are ready for operation, and that components and subsystems designed to operate with the bus in a static condition do function as designed.

**Total bus operation**

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion.

Each bus shall be driven for a minimum of 15 miles during the road tests. If requested, computerized diagnostic printouts showing the performance of each bus shall be produced and provided to the City. Observed defects shall be recorded on the test forms. The bus shall be retested when defects are corrected and adjustments are made. This process shall continue until defects or required adjustments are no longer detected.

**Post-delivery tests**

The City shall conduct acceptance tests on each delivered bus. These tests shall be completed within 15 days after bus delivery and shall be conducted in accordance with the City's written test plans. The purpose of these tests is to identify defects that have become apparent between the time of bus release and delivery to the City. The post-delivery tests shall include visual inspection and bus operations. No post-delivery test shall apply new criteria that are different from criteria applied in a pre-delivery test.

Buses that fail to pass the post-delivery tests are subject to non-acceptance. The City shall record details of all defects on the appropriate test forms and shall notify the contractor of acceptance or non-acceptance of each bus, after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in the contract.

**Prototype/pilot vehicle acceptance**

In order to assess the contractor's compliance with the Technical Specifications, the City and the contractor shall, at the pre-production meeting, jointly develop a Configuration and Performance Review document for review of the pilot vehicle. This document shall become part of the official record of the pre-production meeting.

Potential dimensional/performance tests that may be included in the Configuration and Performance Review include the following:

- Complete electrical system audit
- Dimensional requirements audit
- Seating capacity
- Water test
- Water runoff test
- Function test of systems/subsystems and components
- Sound/noise level tests
- Vehicle top speed
- Acceleration tests
- Brake stop tests
- Airflow tests
- PA function tests
- Air/brake system audit
- Individual axle weight
- Standee capacity
- Body deflection tests
- Silent alarm function test

- Interior lighting
- Exterior lighting
- Gradability test
- Kneeling system function
- HVAC pulldown/heat
- Speedometer
- Outside air infiltration (smoke)
- Wheelchair ramps
- Engine performance qualification
  - This test shall be jointly conducted by the contractor and engine manufacturer (including but not limited to charge air cooler performance, air to boil test, loss of coolant, fuel system electrical inputs and engine protection system).
- Transmission performance qualifications
  - This test shall be jointly conducted by the successful Offeror and transmission manufacturer (including but not limited to retarder operation, heat exchanger, interface with ABS and electrical inputs).

### **Buy America audit**

A post-delivery Buy America audit is required for federally funded bus procurements (see 49 CFR Part 663 for additional information). The onsite resident inspectors are to monitor the production processes to verify compliance with final assembly requirements identified by the Buy America pre-award audit. This audit is to verify compliance with final assembly requirements and final documentation of Buy America compliance and must be completed prior to title transfer.

**NOTE:** If there is not a pilot/prototype bus, then the Buy America post-delivery audit should be performed following completion of the first serial production bus. In addition to monitoring of the production processes, the City must verify compliance that more than 60 percent of the costs of all components are produced in the United States. Finally, the City must execute the required certificates.

### **Resident inspection process for serial production**

At the discretion of the City, a decision is made to perform resident inspection using the City's personnel, a contract inspector, or a combination of both. The decision is based on factors such as the availability of personnel, knowledge/expertise in bus build project management, the size of the bus order, etc.

**NOTE:** The decision to have the resident inspection performed by City personnel results in a firm understanding and knowledge of the bus and affords the opportunity to identify parts that will be needed for general maintenance down the road.

### **Inspector responsibilities**

The resident inspection process for the serial production of the buses begins following the completion and acceptance of the prototype or pilot vehicle if required, or according to the serial bus production schedule. Resident inspectors should represent the City for all build-related issues (quality, conformance, etc.). Resident inspectors can also address contractual type issues but should only do so under the consult of the City's contracts administrator. Resident inspectors are sent to the manufacturer's facility according to a Resident Inspection Schedule. Typically, one or two inspectors arrive on site at the manufacturing facility about one week prior to actual production to set up the resident inspection process and to begin preliminary quality assurance inspections for items such as power plant build-up and wire harness production, and to inspect incoming parts, fasteners, fluids, etc., that will be used in the production of the buses. During the

serial production of the buses, the resident inspectors should monitor the production of each bus, verifying the quality of materials, components, sub-assemblies and manufacturing standards. In addition, the configuration of each vehicle should be audited using the vehicle manufacturer's Build Specification and other documents to ensure contract compliance and uniformity.

### **Inspector rotation/scheduling**

During the resident inspection phase, a single inspector or multiple inspectors could be used. If it is decided to use multiple inspectors, then the inspectors could be rotated on a biweekly to monthly basis as required. During the rotation of inspectors, a sufficient period of overlap should be provided to guarantee the consistency of the resident inspection process.

### **Resident inspector orientation**

A resident inspector orientation by the bus manufacturer should take place upon the arrival of the initial inspection team. The orientation should include expectations for the use of personal protective equipment (safety shoes, safety glasses, etc.), daily check-in and check-out requirements, lines of communication, use of production documents such as speed memos and line movement charts, inspector/production meetings, inspector office arrangements, and anything else pertinent to the inspection team's involvement during the build. Many of the above items should already be formalized during the pre-production meeting.

### **Audits, inspections and tests**

The resident inspection process monitors the production of each vehicle. Inspection stations should be strategically placed to test or inspect components or other installations before they are concealed by subsequent fabrication or assembly operations. These locations typically are placed for the inspection of underbody structure, body framing, electrical panels and harnesses, air and hydraulic line routings, installation of insulation, power plant build-up and installation, rust inhibitor/undercoating application, floor installation, front suspension alignment, and other critical areas.

### **Vehicle inspections**

Each bus is subjected to a series of inspections after the bus reaches the point of final completion on the assembly line. Typically, the vehicle manufacturer performs its own quality assurance inspections following assembly line completion before releasing each bus to the resident inspectors. The inspections for each vehicle are documented, signed off upon passing and included in the vehicle record.

These are the typical inspections performed on each bus by the resident inspectors:

- Water test inspection
- Road test inspection
- Interior inspection (including functionality)
- Hoist/undercarriage inspection
- Exterior inspection (including roof)
- Electrical inspection
- Wheelchair ramp/lift inspection

### **Water test inspection**

The water test inspection checks the integrity of the vehicle's body seams, window frame seals and other exterior component close-outs for their ability to keep rainwater, road splash, melting snow and slush, and other exterior water from entering the inside of the vehicle. The vehicle's interior is inspected for signs of moisture and water leaks. To perform the leak inspection, interior ceiling and side panels are removed, and



access doors are opened. If any moisture or water is detected, then the source of the leak will be located and repaired by the manufacturer, and the vehicle will be tested again.

### **Road test inspection**

The road test inspection checks all the vehicle's systems and sub-systems while the vehicle is in operation. Typically, the road test inspection is performed immediately following the water test inspection to reveal any standing water that may be present due to a leak, but was not noticed during the "static" water test. Objectionable vibrations, air leakage and other factors that affect ride quality are recorded and reported to the vehicle manufacturer for resolution. Vehicle stability, performance, braking and interlock systems, HVAC, and other critical areas are checked to ensure that the vehicle is complete and ready to provide safe and reliable service.

The following tests may be performed and recorded during the road test:

- Acceleration test
- Top speed test
- Gradability test
- Service brake test
- Parking brake test
- Turning effort test
- Turning radius test
- Shift quality
- Quality of retarder or regenerative braking action

During the road test, a vehicle may be taken to a weigh station to record the vehicle's front axle weight, rear axle weight and total vehicle (curb) weight.

### **Interior inspection**

The interior inspection checks the fit and finish of the interior installations.

In addition, the inspection also verifies the installation and function of systems and subsystems according to the Build Specification. All systems and functions accessed from the interior are inspected for functionality, appearance and safety.

Examples of systems/functions inspected include the following:

- Interior and exterior lighting controls
- Front and rear door systems
- Flooring installation
- Passenger and operator's seat systems
- Wheelchair securement and ramp systems
- Fire suppression system
- Electrical installations (multiplex, tell-tale wiring, panels, etc.)
- Window systems and emergency escape portals
- Operator dash/side panel controls/indicators

### **Hoist/undercarriage inspection**

The hoist/undercarriage inspection checks the installation of components, wiring, air lines, presence of fluid leaks, etc., located under the vehicle. Typically, this inspection is performed following the road test. The

vehicle is lifted onto a hoist or pulled over a pit for the inspection. Areas inspected are the front suspension, air bags, airline routings, electrical connections and routings, drive-train components, linkages, and any other system or component that may be prone to early failure due to inadequate installation techniques. All lines, cables, hoses, etc., are inspected for proper securement and protection to prevent rubbing, chafing or any other condition that could result in a failure. The engine/powerplant and HVAC compartments are also inspected during this time.

### **Exterior inspection**

The exterior inspection checks the fit and finish of components installed on the exterior of the vehicle. Access panels are opened and accessories are inspected for proper installation. In addition, vehicle paint, graphics and proper decals are also inspected. Acceptable paint finish quality (orange peel, adhesion, etc.) should be agreed on with the vehicle manufacturer prior to production to ensure consistency of inspections.

### **Electrical inspection**

The vehicle's main electrical panels and other sub-panels are inspected for proper components, to include relays, fuses, modules, terminal strips, decals, etc. In addition, electrical harnesses are inspected for proper wiring and termination techniques, bulkhead protection, looming and other items that could result in future electrical failure. Onboard vehicle compartment schematics are verified for accuracy.

### **Wheelchair ramp inspection**

The wheelchair ramp assembly is inspected for proper installation and performance. Clearances critical to the operation of the ramp are verified, and the ramp's electrical systems are inspected to ensure appropriate wire routings and protection. The successful integration of the ramp assembly into the vehicle is verified, and the vehicle interlocks are checked during automatic and manual ramp operation.

### **Audits**

During serial production of the bus's quality assurance inspection, tests may be performed to ensure that the manufacturer's quality standards are being followed. These inspection audits could be on items such as torque wrench calibrations, proper techniques for fastener installations, proper use and type of adhesives, use of correct installation drawings on the production line, etc.

### **Communications**

The lines of communications, formal and informal, should be discussed and outlined in the pre-production meeting. As previously discussed, resident inspectors should represent the City for all bus-build related issues (quality, conformance, etc.). Resident inspectors can relay communications addressing contractual type issues but should do so only under the consult of the City's contracts administrator. Actual personnel contacts for the manufacturing facility should be established during resident inspector orientation. These contacts could include quality assurance, production, material handling, engineering, and buy-off area personnel.

### **Documentation**

The following documents/reports are typically generated during the bus build process:

- Vehicle Build Specification
- Sales Order
- Pre-production meeting notes
- Prototype and production correspondence (vehicle build file)

- Manufacturer's Vehicle Record (Warranty file)
  - Vehicle line documents
  - Serialization documents (Warranty file)
  - Alignment verification
  - Brake testing
  - HVAC testing and checkout
  - Manufacturer's QA checklist and signoff
  - Weight Slip (Prototype & Warranty file)
  - Prototype Performance Tests document (vehicle build file)
  - Acceleration Test
  - Top Speed Test
  - Gradability Test
  - Interior Noise Test A – Stationary
  - Interior Noise Test B – Dynamic
  - Exterior Noise Test A – Pull Away
  - Exterior Noise Test B – Pass-By
  - Exterior Noise Test C – Curb Idle
  - Turning Radius Test
  - Turning Effort Test
  - Parking Brake Test
  - Service Brake Test
- Vehicle Acceptance Inspections – Production (Warranty file)
  - Water Test Inspection Report
  - Road Test Inspection Report
  - Interior Inspection Report
  - Hoist/Undercarriage Inspection Report
  - Exterior Inspection Report
  - Electrical Inspection Report
  - Wheelchair Inspection Report
- Speed Memos (Warranty file)
- City Vehicle Inspection record (Warranty file)
- Release for Delivery documentation (Warranty file)
- Post-Production Acceptance – Certificate of Acceptance (Accounting)
- Post-Delivery Inspection Report – (Fleet Management & Warranty files)

### **Vehicle release for delivery**

Upon satisfactory completion of all inspection, audit and test criteria, and resolution of any outstanding issues affecting the purchase of any or all buses, proper documentation (the Release for Delivery) is signed by the designated resident inspector authorizing the bus manufacturer to deliver the vehicle to the City's facility, where it will undergo a post-delivery inspection process and final acceptance. The satisfactory sign-off of the Release for Delivery should complete the resident inspector's duties for each bus. In final preparation for delivery, the bus manufacturer may request the resident inspector to do a final walk-through of the bus after it has been cleaned and prepped for shipping.

### **Post-delivery and final acceptance**

The City shall conduct acceptance tests on each delivered bus. These tests shall be completed within 15 days after bus delivery and shall be conducted in accordance with the City's written test plans. The purpose of these tests is to identify defects that have become apparent between the time of bus release and delivery to

the City. The post-delivery tests shall include visual inspection, along with a verification of system(s) functionality and overall bus operations. No post-delivery test shall apply new criteria that are different from criteria applied in a pre-delivery test.

Buses that fail to pass the post-delivery tests are subject to non-acceptance. The City shall record details of all defects on the appropriate test forms and shall notify the contractor of acceptance or non-acceptance of each bus within five days after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in the contract after non-acceptance.

#### **Certificate of Acceptance**

- **Accepted**
- **Not accepted:** In the event that the bus does not meet all requirements for acceptance. The City must identify reasons for non-acceptance and work with the OEM to develop a timeline of addressing the problem for a satisfactory resolution and redelivery.
- **Conditional acceptance:** In the event that the bus does not meet all requirements for acceptance, the City may conditionally accept the bus and place it into revenue service pending receipt of contractor furnished materials and/or labor necessary to address the identified issue(s).

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## Part 4 - EVALUATION OF PROPOSALS

**4.1 Selection Process.** The Mayor of Albuquerque shall name, for the purpose of evaluating the proposals, an Ad Hoc Advisory Committee. On the basis of the evaluation criteria established in this RFP, the Committee shall submit to the Mayor a list of qualified firms in the order in which they are recommended. Proposal documentation requirements set forth in this RFP are designed to provide guidance to the Offeror concerning the type of documentation that will be used by the Ad Hoc Advisory Committee. Offerors should be prepared to respond to requests by the Purchasing Office on behalf of the Ad Hoc Advisory Committee for oral presentations, facility surveys, demonstrations or other areas deemed necessary to assist in the detailed evaluation process. Offerors are advised that the City, at its option, may award this request on the basis of the initial Proposals.

**4.2 Evaluation Criteria.** The following general criteria, not listed in order of significance, will be used by the Ad Hoc Advisory Committee in recommending contract award to the Mayor. The proposal factors will be rated on a scale of **0-1000** with weight relationships as stated below.

### 4.2.1 Evaluation Factors:

**100** -- The Offeror's Technical Proposal Requirements as described in Section 2.1 of this RFP and plans to meet the requirements of the RFP.

**200** --The Offeror's detailed plans to meet the objectives of each task, activity, etc. on the required Delivery Schedule as described in Section 2.1.3 of this RFP.

**200** -- Experience and qualifications of the Offeror and personnel as shown on staff resumes to perform tasks described in Part 3, Scope of Services.

**100** -- Adequacy of proposed Project Management Plan as described in Section 2.1.3 of this RFP and resources to be used by the Offeror.

**100** --The Offeror's past performance on projects of similar scope and size.

**200** -- The overall ability of the Offeror, as judged by the evaluation committee, to successfully deliver the Contract Deliverables within the proposed Delivery Schedule. This judgment will be based upon factors such as the Project Management Plan and availability of staff and resources.

**100** -- Cost Proposal – The costs proposed by the successful Offeror as described in the Pricing Schedule in Section 2.2 of this RFP to perform the tasks listed in Part 3, Scope of Services. The evaluation of this section will occur after the technical evaluation, based on a cost/price analysis.

**4.2.2 Cost/Price Factors:** The evaluation of cost factors in the selection will be determined by a cost/price analysis using your proposed figures. Please note that the lowest cost is not the sole criterion for recommending contract award.

**4.2.3 Cost Evaluation.** The cost/price evaluation will be performed by the City Purchasing Division or designee. A preliminary cost review will ensure that each Offeror has complied with all cost instructions and requirements. In addition, proposals will be examined to ensure that all proposed elements are priced and clearly presented. Cost proposals that are incomplete or reflect significant inconsistencies or inaccuracies will be scored accordingly or may be rejected by the Ad



Hoc Advisory Committee if lacking in information to determine the value/price/cost relative to the services proposed.

{INTENTIONALLY LEFT BLANK}

**Part 5 - Notice of NO PREFERENCES**

**RFP NO:** \_\_\_\_\_

**NO PREFERENCES ARE AVAILABLE FOR THIS PROCUREMENT BECAUSE:**

- ☐ IT IS EXPECTED THAT THE PURCHASE OR CONCESSION CONTRACT RESULTING FROM THIS PROCUREMENT WILL BE IN EXCESS OF \$5,000,000.
- ☒ THIS PROCUREMENT IS FOR A FEDERAL AID CONSTRUCTION PROJECT, OR INVOLVES THE EXPENDITURE OF FEDERAL FUNDS.

**Part 6**  
**DRAFT AGREEMENT**

**THIS AGREEMENT** is made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_ by and between the City of Albuquerque, New Mexico a municipal corporation, (hereinafter referred to as the "City"), and \_\_\_\_\_, hereinafter referred to as the "Contractor"), a \_\_\_\_\_, whose address is \_\_\_\_\_.

**RECITALS**

**WHEREAS**, the City issued a Request For Proposals for the \_\_\_\_\_ Department, P \_\_\_\_\_, titled " \_\_\_\_\_", which is Exhibit A to this Agreement; and

**WHEREAS**, the Contractor submitted its proposal, dated \_\_\_\_\_, in response to RFP \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_, which proposal is Exhibit B to this Agreement; and

**WHEREAS**, the City desires to engage the Contractor to render certain services in connection therewith, and the Contractor is willing to provide such services.

**NOW, THEREFORE**, in consideration of the premises and mutual obligations herein, the parties hereto do mutually agree as follows:

1. **Scope of Services.** The Contractor shall perform the following services (hereinafter the "Services") in a satisfactory and proper manner, as determined by the City:

Provide **18 sixty foot five door ART buses**, in accordance with Exhibit A as supplemented by Exhibit B.

2. **Time of Performance.** Services of the Contractor shall commence on the date of final execution of this Agreement and shall be undertaken and completed in such sequence as to assure their expeditious completion in light of the purposes of this Agreement; provided, however, that in any event, all of the Services required hereunder shall be completed within five (5) years of the date of execution of this Agreement.

3. **Compensation and Method of Payment.**

A. **Compensation.** For performing the Services specified in Section 1 hereof, the City agrees to pay the Contractor as provided in the Pricing Schedule, attached as Exhibit C, which amount includes any applicable gross receipts taxes and which amount shall constitute full and complete compensation for the Contractor's Services under this Agreement, including all expenditures made and expenses incurred by the Contractor in performing such Services.

B. **Method of Payment.** Such amount shall be paid to the Contractor in installments, which include any applicable gross receipts taxes, as provided in Section SP 5 of the RFP. Payments shall be made to the Contractor upon completion of each task, upon receipt by the City of a properly documented requisition for payment as determined by the budgetary and fiscal guidelines of the City and on the condition that the Contractor has accomplished the Services to the satisfaction of the City.

C. **Appropriations.** Notwithstanding any other provisions in this Agreement, the terms of this Agreement are contingent upon the City Council of the City of Albuquerque making the appropriations necessary for the performance of this Agreement. If sufficient appropriations and authorizations are not made by the City Council, this Agreement may be terminated at the end of the City's then current fiscal year upon written notice given by the City to the Contractor. Such event shall not constitute an event of default. All payment obligations of the City and all of its interest in this Agreement will cease upon the date of termination. The City's decision as to whether sufficient appropriations are available shall be accepted by the Contractor and shall be final.

4. **Liquidated Damages.**

A. It is mutually understood and agreed by and between the parties to this Agreement that time is of the essence with respect to the completion of the Work and that in case of any failure on the part of the Contractor to deliver the buses within the time specified in Exhibit A, the City will be damaged thereby. Because the amount of said damages, is difficult if not impossible of definite ascertainment and proof, it is hereby agreed that the amount of such damages due to the City shall be fixed at Two Hundred Seventy-Five Dollars (\$275.00) per calendar day per bus not delivered in substantially good condition as inspected by the City at the time released for shipment.

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

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

5. **Independent Contractor.** The Contractor is considered as an independent contractor at all times in the performance of the services described in Section 1. The Contractor further agrees that neither it nor its employees are entitled to any benefits from the City under the provisions of the Workers' Compensation Act of the State of New Mexico, or to any of the benefits granted to employees of the City under the provisions of the Merit System Ordinance as now enacted or hereafter amended.

6. **Personnel.**

A. The Contractor represents that it has, or will secure at its own expense, all personnel required in performing all of the Services required under this Agreement. Such personnel shall not be employees of or have any contractual relationships with the City.

B. All the Services required hereunder will be performed by the Contractor or under its supervision and all personnel engaged in the work shall be fully qualified and shall be authorized or permitted under state and local law to perform such Services.

C. None of the work or Services covered by this Agreement shall be subcontracted without the prior written approval of the City. Any work or Services subcontracted hereunder shall be specified by written contract or agreement and shall be subject to each provision of this Agreement.

7. **Indemnity.** The Contractor agrees to defend, indemnify and hold harmless the City and its officials, agents and employees as provided in Exhibit A, Part 3, Section 3.1, General Conditions, Section GC 9.1.1. The indemnity required hereunder shall not be limited by reason of the specification of any particular insurance coverage in this Agreement.

8. **Bonds and Insurance.** The Contractor shall not commence any work under this Agreement until the insurances required in Exhibit A, Section 1.23 and the bonds per the attachments to Exhibit A have been obtained and the proper certificates and riders or endorsements (or policies) have been submitted to the City.

9. **Discrimination Prohibited.** In addition to the requirements provided in Exhibit A, Part 3.1 General Conditions, Section GC 9.12 and Section 4 of the Federal Requirements set forth in the RFP, in performing the Services required hereunder, the Contractor shall not discriminate against any person on the basis of race, color, religion, gender, sexual preference, sexual orientation, national origin or ancestry, age, physical handicap or disability, as defined in the Americans With Disabilities Act of 1990, as currently enacted or hereafter amended.

10. **ADA Compliance.** In performing the Services required hereunder, the Contractor agrees to meet all the requirements of the Americans With Disabilities Act of 1990 (the "ADA"), which are imposed directly on the Contractor or which would be imposed on the City as a public entity. The Contractor agrees to be responsible for knowing all applicable rules and requirements of the ADA and to defend, indemnify and hold harmless the City, its officials, agents and employees from and against any and all claims, actions, suits or proceedings of any kind brought against said parties as a result of any acts or omissions of the Contractor or its agents in violation of the ADA.

11. **Reports and Information.** At such times and in such forms as the City may require, there shall be furnished to the City such statements, records, reports, data and information, as the City may request pertaining to matters covered by this Agreement. Unless authorized by the City, the Contractor will not release any information concerning the work product including any reports or other documents prepared pursuant to the Agreement until the final product is submitted to the City.

12. **Open Meetings Requirements.** Any nonprofit organization in the City which receives funds appropriated by the City, or which has as a member of its governing body an elected official, or appointed administrative official, as a representative of the City, is subject to the requirements of §2-5-1 *et seq.* R.O.A. 1994, Public Interest Organizations. The Contractor agrees to comply with all such requirements, if applicable.

13. **Establishment and Maintenance of Records.** In addition to the requirements provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.4.2, records shall be maintained by the Contractor in accordance with applicable law and requirements prescribed by the City with respect to all matters covered by this Agreement. Except as otherwise authorized by the City, such records shall be maintained for a period of three (3) years after receipt of final payment under this Agreement.

14. **Audits and Inspections.** The Contractor agrees to comply with the following in addition to Exhibit A, Part 3.1, General Conditions, Section GC 9.4.2 and Section 1 of the the Federal Requirements set



forth in the RFP. At any time during normal business hours and as often as the City may deem necessary, there shall be made available to the City for examination all of the Contractor's records with respect to all matters covered by this Agreement. The Contractor shall permit the City to audit, examine, and make excerpts or transcripts from such records, and to make audits of all contracts, invoices, materials, payrolls, records of personnel, conditions of employment and other data relating to all matters covered by this Agreement. The Contractor understands and will comply with the City's Accountability in Government Ordinance, §2-10-1 et seq. and Inspector General Ordinance, §2-17-1 et seq. R.O.A. 1994, and also agrees to provide requested information and records and appear as a witness in hearings for the City's Board of Ethics and Campaign Practices pursuant to Article XII, Section 8 of the Albuquerque City Charter.

**15. Publication, Reproduction and Use of Material.** No material produced in whole or in part under this Agreement shall be subject to copyright in the United States or in any other country. The City shall have unrestricted authority to publish, disclose, distribute and otherwise use, in whole or in part, any reports, data or other materials prepared under this Agreement.

**16. Compliance with Laws.** In addition to the requirement provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.5, in providing the Scope of Services outlined herein, the Contractor shall comply with all applicable laws, ordinances, and codes of the federal, State, and local governments.

**17. Changes.** The City may, from time to time, request changes in the Scope of Services of the Contractor to be performed hereunder. Such changes, including any increase or decrease in the amount of the Contractor's compensation, which are mutually agreed upon by and between the City and the Contractor, shall be incorporated in written amendments to this Agreement. Any modification or amendment of any provisions of any of the contract resulting from this RFP shall be effective only if in writing, signed by authorized representatives of both the City and successful Offeror, and specifically referencing the contract resulting from this RFP.

**18. Assignability.** The Contractor shall not assign any interest in this Agreement and shall not transfer any interest in this Agreement (whether by assignment or novation), without the prior written consent of the City thereto.

**19. Termination for Cause.** Termination for cause shall be as provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.42 .

**20. Termination for Convenience of City.** Termination for convenience shall be as provided in Exhibit A, Part 3.1, General Conditions, Section GC 9.41 .

**21. Dispute Resolution.** Dispute resolution shall be as provided in Exhibit A, Part 3.1., General Conditions, Section GC 9.8.

**22. Construction and Severability.** If any part of this Agreement is held to be invalid or unenforceable, such holding will not affect the validity or enforceability of any other part of this Agreement so long as the remainder of the Agreement is reasonably capable of completion.

**23. Enforcement.** The Contractor agrees to pay to the City all costs and expenses including reasonable attorney's fees incurred by the City in exercising any of its rights or remedies in connection with the enforcement of this Agreement.

**24. Entire Agreement.** This Agreement contains the entire agreement of the parties and supersedes any and all other agreements or understandings, oral or written, whether previous to the execution hereof or contemporaneous herewith. Exhibits A, B, and C, attached hereto, are hereby made a part of this Agreement. By signing this Agreement, the Contractor expressly agrees that the General Conditions, Special Provisions, and Federal Requirements set forth in the RFP are incorporated herein.

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

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

**27. Applicable Law.** This Agreement shall be governed by and construed and enforced in accordance with the laws of the State of New Mexico, and the laws, rules and regulations of the City of Albuquerque.

**28. Approval Required.** This Agreement shall not become effective or binding until approved by the City's Chief Administrative Officer.

**IN WITNESS WHEREOF**, the City and the Contractor have executed this Agreement as of the date first above written.

**CITY OF ALBUQUERQUE**

**CONTRACTOR:**

**Approved By:**

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

\_\_\_\_\_  
**Robert Perry, Chief Administrative Officer**

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

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

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

\_\_\_\_\_  
**Bruce Rizzieri, Transit Director**

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

**Appendix A**  
**Pre-Award Evaluation Data Form**

**1. Name of firm:**

**2. Address:**

**3. ☐ Individual ☐ Partnership ☐ Corporation ☐ Joint Venture**

**4. Date organized:**

**State in which incorporated:**

**5. Names of officers or partners:**

- a.
- b.
- c.
- d.
- e.

**6. How long has your firm been in business under its present name?**

**7. Attach as SCHEDULE ONE** a list of similar current contracts that demonstrates your available capacity, including the quantity and type of bus, name of contracting party, percentage completed and expected completion date.

**8. Attach as SCHEDULE TWO** a list of at least three similar contracts that demonstrates your technical proficiency, each with the name of the contracting party and number and they type of buses completed within the last five years.

**9. Have you been terminated or defaulted, in the past five years, on any Contract you were awarded?**

☐ Yes ☐ No

If yes, then attach as **SCHEDULE THREE** the full particulars regarding each occurrence.

**10. Attach as SCHEDULE FOUR** Offeror's last three (3) financial statements prepared in accordance with generally accepted accounting principles of the jurisdiction in which the Offeror is located, and audited by an independent certified public accountant; or a statement from the Offeror regarding how financial information may be reviewed by the City.

**11. Attach as SCHEDULE FIVE** a list of all principal Subcontractors and the percentage and character of Work (Contract amount) that each will perform on this Contract.

**12. If the Contractor or Subcontractor is a joint venture, submit PRE-AWARD EVALUATION DATA forms for each member of the joint venture.**

The above information is confidential and will not be divulged to any unauthorized personnel.

The undersigned certifies to the accuracy of all information:

**Name and title:**

**Company:**

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

\_\_\_\_\_  
 Date

**APPENDIX B**  
**Contractor Service and Parts Support Data**

**Location of nearest Technical Service Representative to City**

Name:

Address:

Telephone:

Describe technical services readily available from said representative:

**Location of nearest Parts Distribution Center to City:**

Name:

Address:

Telephone:

Describe the extent of parts available at said center:

**Policy for delivery of parts and components to be purchased for service and maintenance:**

Regular method of shipment:

Cost to City:



**APPENDIX C**  
**Form for Proposal Deviation**

This form shall be completed for each condition, exception, reservation or understanding (i.e., Deviation) in the Proposal according to "Conditions, Exceptions, Reservations or Understandings." One copy without any price/cost information is to be placed in the Technical Proposal as specified in "Technical Proposal Requirements," and a separate copy with any price/cost information placed in the Price Proposal as specified in "Price Proposal Requirements."

<b>Deviation No.:</b>	<b>Contractor:</b>	<b>RFP section:</b>	<b>Page:</b>
<b>Complete description of Deviation:</b>			
<b>Rationale (pros and cons):</b>			

**APPENDIX C**  
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<b>Deviation No.:</b>	<b>Contractor:</b>	<b>RFP section:</b>	<b>Page:</b>
<b>Complete description of Deviation:</b>			
<b>Rationale (pros and cons):</b>			

## APPENDIX D

### Vehicle Questionnaire

This form must be completed and included in the Technical Proposal.

### GENERAL COACH DATA SHEET: 60 FOOT 5 DOOR BRT BUS

**Bus Manufacturer:**

---

**Bus Model Number:**

---

**Basic Body Construction Type:**

---

#### General Dimensions

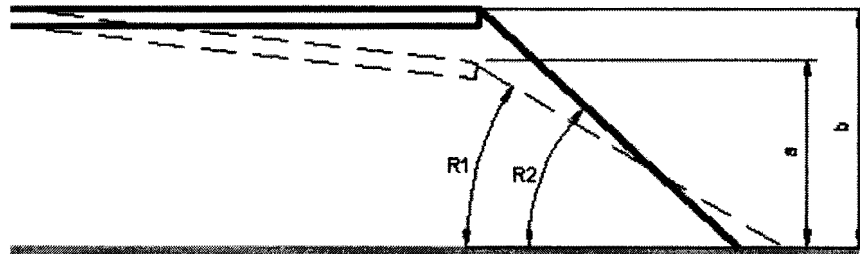
<b>Overall length</b>	Over bumpers	<input type="text"/>	feet	<input type="text"/>	inches
	Over body	<input type="text"/>	feet	<input type="text"/>	inches
<b>Overall width</b>	Over body excluding mirrors and lights	<input type="text"/>	feet	<input type="text"/>	inches
	Over body including mirrors	<input type="text"/>	feet	<input type="text"/>	inches
	Over tires	<input type="text"/>	feet	<input type="text"/>	inches
<b>Overall height (maximum)</b>		<input type="text"/>	feet	<input type="text"/>	inches

<b>Angle of approach</b>	<input type="text"/>	Degrees
<b>Angle of departure</b>	<input type="text"/>	Degrees
<b>Breakover angle 1</b>	<input type="text"/>	Degrees
<b>Breakover angle 2</b>	<input type="text"/>	Degrees

**Doorway clear opening (at widest point)**  Inches

	<b>Width with grab handles</b>	<b>Width without grab handles</b>	<b>Height</b>
<b>Front door</b>	<input type="text"/> inches	<input type="text"/> inches	<input type="text"/> inches
<b>Center door (1)</b>	<input type="text"/> inches	<input type="text"/> inches	<input type="text"/> inches
<b>Center door (2)</b>	<input type="text"/> inches	<input type="text"/> inches	<input type="text"/> inches
<b>Rear door</b>	<input type="text"/> inches	<input type="text"/> inches	<input type="text"/> inches

Front axle floor height above ground (centerline of bus)	<input type="text"/>	inches
Center axle floor height above ground (centerline of bus)	<input type="text"/>	inches
Rear axle floor height above ground (centerline of bus)	<input type="text"/>	inches
Step height from ground (measured at center of doorway)	<input type="text"/>	inches



	Front doorway	Center doorway	Ramp angle	Rear doorway
<b>Kneeled</b>	<input type="text"/> inches (a)	<input type="text"/> inches (a)	<input type="text"/> degrees (R1)	<input type="text"/> inches (a)
<b>Unkneeled</b>	<input type="text"/> inches (b)	<input type="text"/> inches (b)	<input type="text"/> degrees (R2)	<input type="text"/> inches (b)

#### Interior head room (floor to ceiling at center of aisle)

First axle location	<input type="text"/>	Inches
Center of articulation	<input type="text"/>	Inches
Rear axle location	<input type="text"/>	Inches
Rear settee (in front of seat)	<input type="text"/>	Inches

#### Aisle width

Minimum width on floor between first axle wheel housings	<input type="text"/>	inches
Minimum width on floor between center axle (1) wheel housings	<input type="text"/>	inches
Minimum width on floor between center axle (2) wheel housings	<input type="text"/>	inches
Minimum width on floor between rear axle wheel housings	<input type="text"/>	inches

#### Minimum ground clearance

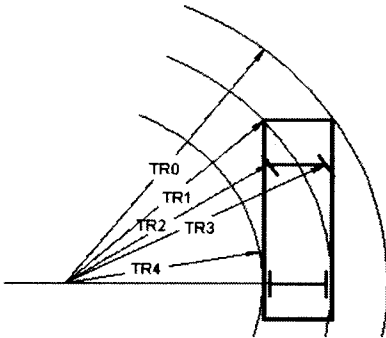
Outside axles zones	<input type="text"/>	Inches
Inside axles zones	<input type="text"/>	Inches

**Horizontal turning envelope** (see diagram below)

Outside body turning radius, TR0 (including bumper)

Inside Body Turning Radius innermost point, TR4 (including bumper)

	feet		inches
	feet		inches

**Wheel base** Changes to reflect third axle

First axle to center/rear axle

	Inches
	Inches

Center axle to rear axle

**Overhang, centerline of axle over bumper**

Front

	Inches
	Inches

Rear

**Floor**Maximum interior floor slope (from horizontal)  degrees**Capacity**

Total number of passenger sittings

Passenger seating manufacturer/model number

Total number of standing passengers (1 per 1.5 sq. ft.)

Minimum hip to knee space

Maximum hip to knee space

Restraint system type and model number

	inches
	inches

**Bus weight****Curb weight****Curb weight plus seated load\*****GVWR**



First axle	<input type="text"/>	lbs	<input type="text"/>	Lbs	<input type="text"/>	lbs
Center axle	<input type="text"/>	lbs	<input type="text"/>	Lbs	<input type="text"/>	lbs
Rear axle	<input type="text"/>	lbs	<input type="text"/>	Lbs	<input type="text"/>	lbs
Total	<input type="text"/>	lbs	<input type="text"/>	Lbs	<input type="text"/>	lbs

\* Including operator and passengers at 150 lbs. per person

### Steering Axles

Manufacturer

Type and weight rating

Model number


### Drive axle (☐ Center ☐ Rear)

Manufacturer

Type and weight rating

Model number


### Drive axle ratio

Differential ratio

Hub reduction ratio (if used)

Final axle ratio (if hub reduction is used)


### Brake system

Make/type of fundamental system

First axle brake chamber model

Center axle brake chamber model

Rear axle brake chamber model

First axle slack adjuster

Manufacturer

Model number

Center axle slack adjuster

Manufacturer

Model number

Rear axle slack adjuster

Manufacturer

Model number





First axle brake drum/rotor

Manufacturer

Center axle brake drum/rotor

Manufacturer

Rear axle brake drum/rotor

Manufacturer

**Air compressor**

Manufacturer

Type

Model number

Rated capacity

Cfm

Capacity at idle

Cfm

Maximum warranted speed

Rpm

Idle speed

Rmp

Drive type

Governor cut-in pressure

Psi

Governor cut-out pressure

Psi

**Air Reservoir Capacity**

Manufacturer

Supply reservoir number and size

/

cubic inches total

Primary reservoir number and size

/

cubic inches total

Secondary reservoir number and size

/

cubic inches total

Parking reservoir number and size

/

cubic inches total

Accessory reservoir number and size

/

cubic inches total

Other reservoir number and size

/

cubic inches total

**Cooling System**

Radiator

Charge air cooler

Manufacturer

Type

Model number

Number of tubes

Fins per inch

Fin thickness  
(inches)

Fin construction


Total cooling system capacity (gallons)

Gallons

Radiator fan manufacturer

Fan speed/control type  
(mech/elect/hyb)

Surge tank capacity

Gallons

Surge tank material

Overheat alarm temperature

degrees F

Shutdown temperature settings

degrees F

### Electrical

#### Primary interior lighting system

Manufacturer

Type

Model number


#### Alternator

Manufacturer

Type

Model number

Output at idle

Amps


#### Voltage regulator

Manufacturer

Model number


#### Voltage equalizer

Manufacturer

Model number


#### Auxiliary inverter (120/240)

Manufacturer

Model number

Inverter


technology

Output voltage(s)

**Starter motor**

Manufacturer

Voltage

Model number

**Energy storage**

Batteries – low voltage

Manufacturer

Type

Model number

Cold cranking  
amps

Batteries/energy storage – high voltage

Manufacturer

Type

Model number

Energy density

Specific power

Operating temperature  
range

Cooling/heating system

Ultra-capacitor

Manufacturer

Model number

*Ultra-capacitor ratings: Provide data sheet for energy efficiency, estimated calendar life, cycle life, voltage (each capacitor and each module), working and peak power, and weight*

**Engine**

Manufacturer

Model number/version

Horsepower/torque  
rating

**Fire Suppression/Methane Detection System**

Manufacturer

Model number

Number of detectors

fire

methane

Type of detector

☐ Thermal ☐ Optical

Battery backup

☐ Yes ☐ No**Bumpers**

Manufacturer

Type

**Fuel and Exhaust System**

Fuel type

Operating range and route profile

**Fuel tanks (liquid fuels)**

Manufacturer

Capacity (total and usable)

Gallons

/

Gallons

Construction material

Quantity and location of tanks

**Fuel tanks (gaseous fuels)**

Manufacturer

Capacity (total and usable)

SCF

/

SCF

Construction material

Quantity and location of tanks

**Exhaust system**

Diesel particulate filter manufacturer

Describe DPF electronic interface

Muffler manufacturer (if applicable)



**Air Suspension**

	Front	Middle	Rear
Air spring manufacturer			
Air spring quantity per axle			
Shock absorber manufacturer			
Shock absorber quantity per axle			

**Steering**

Pump manufacturer	
Pump model number	
Steering gear manufacturer	
Steering gear model number	
Steering gear type	
Steering wheel diameter	Inches
Maximum effort at steering wheel*	

\* Unloaded stationary coach on dry asphalt pavement

**Articulation - N/A**

Articulation joint manufacturer	
Articulation joint model number	
Bellows manufacturer	
Bellows model number	

☐ **Transmission** / ☐ **Hybrid drive system** (check one)

Manufacturer	
Type	
Model number	
Number of forward speeds	
Traction motor horsepower rating	
Type ventilation/cooling	

**Propshaft**

Manufacturer

--

**Wheels**

Manufacturer

Type

Size

Mounting type

Bolt circle diameter

Protective coating


**Tires**

Manufacturer

Type

Size

Load range/air pressure


**Door System****Door panels****Manufacturer****Type**

Front door

Center door (1)

Center door (2)

Rear door


**Actuating mechanism (air, electric, spring, other)**

Manufacturer

Front door

Center door (1)

Center door (2)

Rear door


**Heating and Ventilating Equipment**

Heating system capacity

Btu

Air conditioning system  
capacity

Btu

Ventilating capacity

CFM per passenger

Manufacturer and model


Refrigerant type

--

**Driving heater**

Manufacturer

--

Type

--

Model number

--

Capacity

--

**Auxiliary heater**

Manufacturer

--

Type

--

Model number

--

Capacity

--

**Floor heaters**

Manufacturer

--

Type/number

--

Model number

--

Capacity

--

**Passenger Loading System**

Manufacturer

--

Type (hydraulic, electric or both)

--

Model number

--

Capacity (lbs.)

--

**Dimensions**

Width of ramp

--

Inches

Length of ramp

--

Inches

**Cycle times****Normal idle**

Stowed to ground

--

Seconds

Ground to stow

--

Seconds

**Fast idle**

--

seconds

--

seconds

**Electronics**

Video system manufacturer  
Video system model number  
Number of cameras  
Multiplex system manufacturer  
Multiplex system model number  
Automatic passenger counter system manufacturer  
Automatic passenger counter system model number  
Destination sign manufacturer  
Destination sign model number  
AVL/AVM system manufacturer  
AVL/AVM system model number  
Passenger information system manufacturer  
Passenger information system model number  
Signal prioritization system manufacturer  
Signal prioritization system model number


**Coach Body Fittings**

Passenger windows manufacturer

--

**Exterior/interior mirrors**

Size  
Manufacturer  
Model number  
Manufacturer part numbers

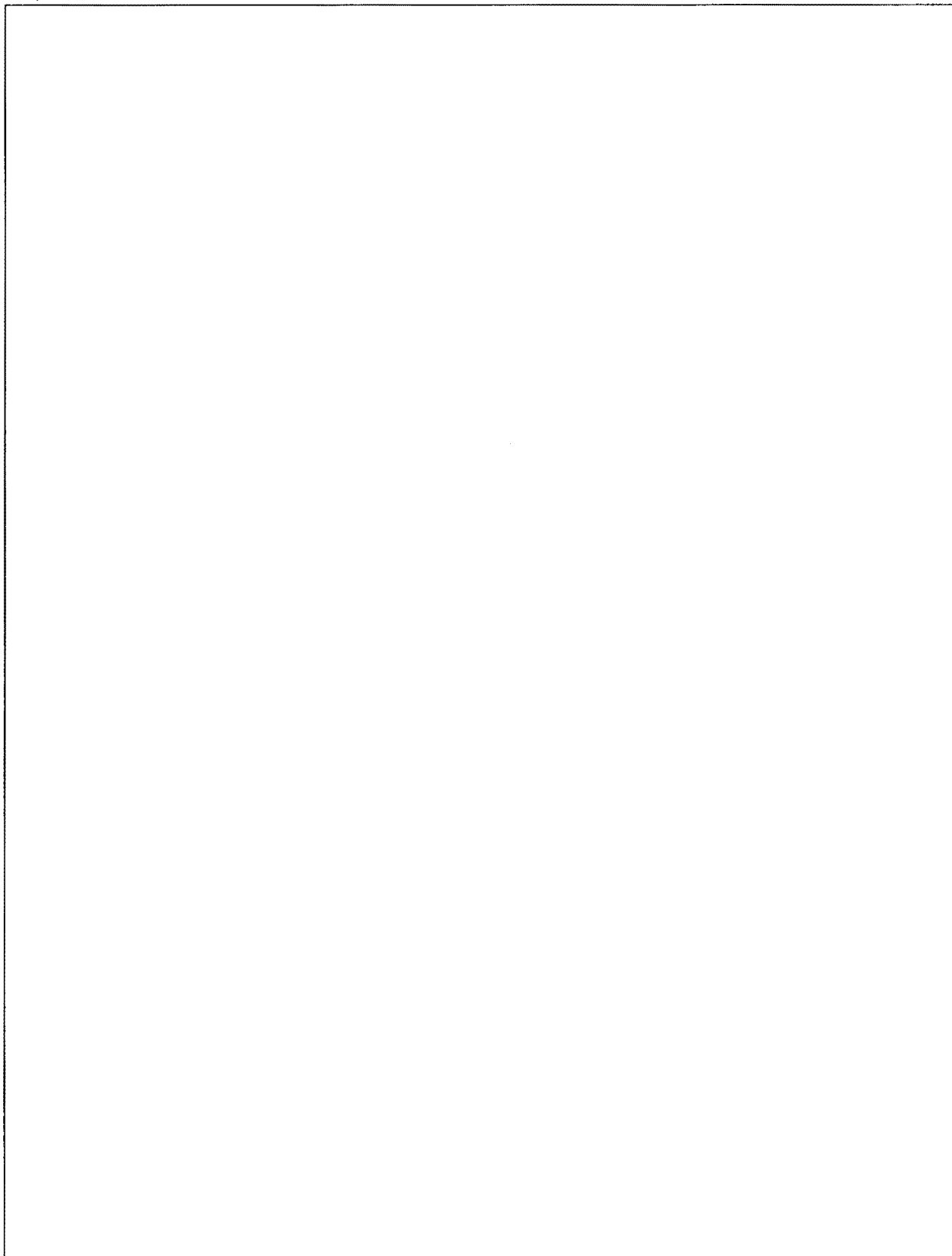

**Bicycle racks**

Manufacturer  
Model number


**Paint system**

Manufacturer  
Type


**Operator control layout diagram:**





## APPENDIX E

### Buy America Certification

This form is to be submitted with any Proposal exceeding the small purchase threshold for federal assistance programs, currently set at \$100,000.

#### Certificate of Compliance

The Offeror hereby certifies that it will comply with the requirements of 49 USC Section 5323(j)(2)(C), Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, and the regulations of 49 CFR 661.11:

**Name and title:**

**Company:**

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

\_\_\_\_\_  
Date

#### Certificate of Non-Compliance

The Offeror hereby certifies that it cannot comply with the requirements of 49 USC Section 5323(j)(2)(C) and Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, but may qualify for an exception to the requirements consistent with 49 USC Sections 5323(j)(2)(B) or (j)(2)(D), Sections 165(b)(2) or (b)(4) of the Surface Transportation Assistance Act, as amended, and regulations in 49 CFR 661.7.

**Name and title:**

**Company:**

\_\_\_\_\_  
Authorized signature

\_\_\_\_\_  
Date

## APPENDIX F

### Debarment and Suspension Certification for Prospective Contractor

Primary covered transactions must be completed by Offeror for contract value over \$25,000.

Choose one alternative:

- ☐ The Offeror, [insert name], certifies to the best of its knowledge and belief that it and its principals:
1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any federal department or City;
  2. Have not within a three-year period preceding this Proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or Contract under a public transaction; violation of federal or state antitrust statutes or commission or embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state, or local) with commission of any of the offenses enumerated in Paragraph 2 of this certification; and
  4. Have not within a three-year period preceding this Proposal had one or more public transactions (federal, state or local) terminated for cause or default.

**OR**

- ☐ The Offeror is unable to certify to all of the statements in this certification, and attaches its explanation to this certification. (In explanation, certify to those statements that can be certified to and explain those that cannot.)

The Offeror certifies or affirms the truthfulness and accuracy of the contents of the statements submitted on or with this certification and understands that the provisions of Title 31 USC § Sections 3801 are applicable thereto.

**Executed in** [insert city and state].

**Name:**

\_\_\_\_\_  
Authorized signature

\_\_\_\_\_  
Date

## APPENDIX G

### Debarment and Suspension Certification (Lower-Tier Covered Transaction)

This form is to be submitted by each Subcontractor receiving an amount exceeding \$25,000.

The prospective lower-tier participant (Offeror) certifies, by submission of this Proposal, that neither it nor its "principals" as defined at 49 CFR § 29.105(p) is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or City.

If the prospective Offeror is unable to certify to the statement above, it shall attach an explanation, and indicate that it has done so by placing an "X" in the following space: \_\_\_\_\_

**THE OFFEROR, \_\_\_\_\_, CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF EACH STATEMENT OF ITS CERTIFICATION AND EXPLANATION, IF ANY. IN ADDITION, THE OFFEROR UNDERSTANDS AND AGREES THAT THE PROVISIONS OF 31 USC §§ 3801 *ET SEQ.* APPLY TO THIS CERTIFICATION AND EXPLANATION, IF ANY.**

**Name and title of the Offeror's authorized official:**

\_\_\_\_\_  
Authorized signature

\_\_\_\_\_  
Date

**APPENDIX H**  
**Non-Collusion Affidavit**

This affidavit is to be filled out and executed by the Offeror; if a corporation makes the bid, then by its properly executed agent. The name of the individual swearing to the affidavit should appear on the line marked "Name of Affiant." The affiant's capacity, when a partner or officer of a corporation, should be inserted on the line marked "Capacity." The representative of the Offeror should sign his or her individual name at the end, not a partnership or corporation name, and swear to this affidavit before a notary public, who must attach his or her seal.

State of _____, County of _____		
I, _____, being first duly sworn,		
do hereby state that _____ <div style="text-align: center;">(Name of Affiant)</div>		
I am _____ of _____ <div style="text-align: center;">(Capacity) (Name of Firm, Partnership or Corporation)</div>		
whose business is _____		
and who resides at _____		
and that _____ <div style="text-align: center;">(Give names of all persons, firms, or corporations interested in the bid)</div>		
is/are the only person(s) with me in the profits of the herein contained Contract; that the Contract is made without any connection or interest in the profits thereof with any persons making any bid or Proposal for said Work; that the said Contract is on my part, in all respects, fair and without collusion or fraud, and also that no members of the Board of Trustees, head of any department or bureau, or employee therein, or any employee of the Authority, is directly or indirectly interested therein.		
_____ Signature of Affiant		_____ Date
Sworn to before me this _____ day of _____, 20____.		Seal
_____ Notary public	_____ My commission expires	

**APPENDIX I**  
**Lobbying Certification**

This form is to be submitted with an Proposal exceeding \$100,000.

The Offeror certifies, to the best its 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 a federal department or City, a member of the U.S. Congress, an officer or employee of the U.S. Congress, or an employee of a member of the U.S. 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 thereof.
2. If any funds other than federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any City, 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 instruction, as amended by "Government-wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96).
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants and contracts under grants, loans and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, USC § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

**THE OFFEROR, \_\_\_\_\_, CERTIFIES OR AFFIRMS THE TRUTHFULNESS AND ACCURACY OF EACH STATEMENT OF ITS CERTIFICATION AND DISCLOSURE, IF ANY. IN ADDITION, THE OFFEROR UNDERSTANDS AND AGREES THAT THE PROVISIONS OF 31 USC §§ 3801 ET SEQ. APPLY TO THIS CERTIFICATION AND DISCLOSURE, IF ANY.**

Name of the bidder or Offeror's authorized official:

\_\_\_\_\_

Title:

\_\_\_\_\_

Signature

Date

Per paragraph 2 of the included form Lobbying Certification, add Standard Form-LLL, "Disclosure Form to Report Lobbying," if applicable.

P \_\_\_\_\_, "Insert RFP Title"



**APPENDIX J****Certificate of Compliance with Bus Testing Requirement**

The undersigned certifies that the vehicle offered in this RFP complies and will, when delivered, comply with 49 USC § 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). If multiple buses are being proposed, provide additional bus testing information below or on attached sheet. 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 Proposal. If the configuration or components are not identical, then the manufacturer shall provide with its Proposal a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing. If multiple buses are being proposed, testing data on additional buses shall be listed on the bottom of this page.
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 Proposal 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 the City 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.

**Company name:**

**Name and title of the Offeror's authorized official:**

\_\_\_\_\_  
Authorized signature

\_\_\_\_\_  
Date

**APPENDIX K**  
**DBE Approval Certification**

I hereby certify that the Offeror has complied with the requirements of 49 CFR 26, Participation by Disadvantaged Business Enterprises in DOT Programs, and that its goals have not been disapproved by the Federal Transit Administration.

**Name and title of the Offeror's authorized official:**

\_\_\_\_\_  
Authorized signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
P\_\_\_\_\_, "Insert RFP Title"

**APPENDIX L**  
**Federal Motor Vehicle Safety Standards**

The Offeror 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

**APPENDIX M-1**  
**Pricing Schedule**  
**FOR 18 – 60-FOOT 5-DOOR DIESEL BUSES**

	All prices are to be in United States dollars	
	Unit Price	Extension
<b>Sixty-foot five-door BRT DIESEL Buses</b>		
Predominate Body Construction Materials		
Seating (including stanchions, grab rails, overhead storage)		
Flooring		
Drive Motor		
Transmission		
Air Compressor & Reservoirs		
Front Axle		
Rear Axle		
Suspension System		
Wheels and Tires		
Power Steering		
Cooling System		
Heating, Ventilating & Air Conditioning Equipment		
Interior Lighting		
Doors		
Passenger Windows		
Mirrors		
Seat (Drivers)		
Driver's Workplace		
Paint		
Wheelchair Ramp Equipment		
Interior Panels		
Other Metal Fabrication		
Destination Signs		
Electrical: Multiplex System		

Electrical: Batteries		
Electrical: Converters		
Electrical: Harnesses		
Electrical: Data Logger		
Electrical: Fire Suppression		
Communication System		
Other Parts		
Labor		
Manuals	Lump Sum	
Training	Lump Sum	
Spare transmissions		
Spare engines		
Test equipment and special tools		
Sales tax (if applicable)		
Delivery charges		
<b>TOTAL PROPOSED PRICE</b>		
Proposed spare parts		
ADA equipment (included in above unit prices)		

This form is to be completed and included in the Cost Proposal.

Offerors that manufacture only diesel powered, 60', 5-door buses may submit proposals based on the diesel bus specifications. Offerors that manufacture only electric powered, 60', 5-door buses may submit proposals based on the electric bus specifications. Offerors that manufacture both diesel powered and electric powered, 60', 5-door buses may submit proposals based on either the diesel bus or electric bus specifications, or both specifications.



**APPENDIX M-2**  
**Pricing Schedule**  
**FOR 18 – 60-FOOT 5-DOOR ELECTRIC BUSES**

	All prices are to be in United States dollars	
	Unit Price	Extension
<b>Sixty-foot five-door BRT ELECTRIC Buses</b>		
Predominate Body Construction Materials		
Seating (including stanchions, grab rails, overhead storage)		
Flooring		
Drive Motor		
Transmission		
Air Compressor & Reservoirs		
Front Axle		
Rear Axle		
Suspension System		
Wheels and Tires		
Power Steering		
Cooling System		
Heating, Ventilating & Air Conditioning Equipment		
Interior Lighting		
Doors		
Passenger Windows		
Mirrors		
Seat (Drivers)		
Driver's Workplace		
Paint		
Wheelchair Ramp Equipment		
Interior Panels		
Other Metal Fabrication		
Destination Signs		
Electrical: Multiplex System		

Electrical: Batteries		
Electrical: Converters		
Electrical: Harnesses		
Electrical: Data Logger		
Electrical: Fire Suppression		
Communication System		
Other Parts		
Labor		
Manuals	Lump Sum	
Training	Lump Sum	
Spare transmissions		
Spare engines		
Test equipment and special tools		
Sales tax (if applicable)		
Delivery charges		
<b>TOTAL PROPOSED PRICE</b>		
Proposed spare parts		
ADA equipment (included in above unit prices)		

This form is to be completed and included in the Cost Proposal.

Offerors that manufacture only diesel powered, 60', 5-door buses may submit proposals based on the diesel bus specifications. Offerors that manufacture only electric powered, 60', 5-door buses may submit proposals based on the electric bus specifications. Offerors that manufacture both diesel powered and electric powered, 60', 5-door buses may submit proposals based on either the diesel bus or electric bus specifications, or both specifications.

**APPENDIX N**  
**Sample Performance Bond Form**

**NOTE:** The following is a sample Performance Bond, which is included as an illustration of a format that an Agency may choose to use.

**FAITHFUL PERFORMANCE BOND**

[insert Agency name]

**CONTRACT NO. \_\_\_\_\_**

[insert title of procurement]

**PERFORMANCE BOND**

**WHEREAS** the [insert Agency name] has awarded to \_\_\_\_\_ ("Principal"), Contract No. \_\_\_\_\_, Up To [Agency to insert quantity and type of bus]AND

**WHEREAS** Principal is required under the terms of the Contract to furnish a Bond for the faithful performance of the Contract;

**NOW, THEREFORE**, we \_\_\_\_\_, as Principal, and \_\_\_\_\_, ("Surety"), as Surety, are held and firmly bound unto [Agency]in the sum of [insert amount], in lawful money of the United States of America, for payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severably, firmly by these presents. In case suit is brought upon this Bond, Surety shall pay reasonable attorneys' fees to [Agency]in an amount to be fixed by the court. In no event shall the surety be liable under this Bond for an amount greater than the aggregate penal sum designated in this paragraph.

The condition of this obligation is such that, if the hereby-bonded Principal or its heirs, executors, administrators, successors, assigns, or Subcontractors shall in all things stand to and abide by and well and truly keep and perform all the undertakings, terms, covenants, conditions and agreements in the Contract and any alteration thereof, made as therein provided, all within the time and in the manner therein-designated and in all respects according to their true intent and meaning, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

Further, Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration, or modification of the Contract, or of the Goods to be furnished thereunder, shall in any way affect its obligations under this Bond, and it does hereby waive notice of any such change, extension of time, alteration, or modification of the Contract or of the Goods and Technical Services to be performed thereunder.