

1. **GENERAL**

These Technical Specifications cover requirements for Heavy-Duty Low Floor Diesel Transit coaches which may be used for rural, suburban, and urban transit service operations on urban streets and rural roadways in the general environmental and climatic conditions prevailing throughout the SRTA operating area. It is intended for the widest possible spectrum of youth and adult passengers, elderly, and the handicapped.

The coach shall be fully compliant with the applicable requirements of the Americans with Disabilities Act (ADA) and any revisions published by the Architectural and Transportation Barriers Compliance Board or The Federal Transit Administration for fixed route operations. Where these specifications exceed the requirements of ADA, the specification requirement shall apply.

2. **CONFORMITY**

- a. All Proposers must conform to these specifications and the product they furnish shall be of first class quality and the workmanship shall be the best obtainable in various trades.
- b. The design of the body, chassis, and equipment the Contractor proposes to furnish shall be of the latest design and model so as to produce a vehicle of substantial and durable construction in all respects.
- c. No advantage shall be taken by the Contractor in the omission of any part or detail which is required to make the buses fully serviceable and durable operational vehicles in all respects even though such parts or detail are not mentioned in these specifications.
- d. All units or parts not specified shall be manufacturer's standard units. In all cases, material and dimensions must be furnished as specified, but if the term, "approved deviation" is used, the SRTA's Director of Maintenance must approve any materials, equipment, or dimensions substituted for those specified.
- e. The vehicle and all related equipment provided under this Contract shall meet all applicable State and Federal laws, vehicle codes, regulations, and standards.

3. **RESPONSIBILITY**

- a. The Contractor shall assume responsibility for all design and satisfactory operation of the vehicle; furnishing and delivering all vehicles, material, and accessories whether or not the same are manufactured by the Contractor or purchased ready-made from an outside source.
- b. The Contractor shall assume responsibility and all costs to deliver the SRTA's designated location and related items specified to the SRTA in accordance with these Solicitation Documents.

4. **VEHICLE DESCRIPTION**

4.1 General Description

- a. It is the intent of this specification to describe the design requirements for a Heavy-Duty Diesel Low Floor Transit coach rugged enough to withstand rigorous intensive daily transit service operations and provide maximum reliability and availability, with a minimum of maintenance and repair time. The coach shall

exhibit maximum passenger appeal in appearance, comfort and safety, combined with excellence in reliability, operating characteristics, efficiency, and economy of operation.

- b. Coaches shall incorporate features essential for safe, fast, efficient and comfortable operation by the operator, features that ensure excellent road and traffic visibility under all driving conditions and adequate means for safe passenger movement. The coach shall be made capable of easy maneuvering in normal and heavy traffic.
- c. The coach shall achieve normal operation in the environmental conditions normally occurring in the area in which the SRTA is located in temperature ranges of -10° F to 120° F, at relative humidities between 5 percent and 100 percent, and at altitudes up to 5,000 feet above sea level.
- d. Coaches are to be used in urban areas, but at the same time must be able to maintain speeds up to 65 MPH for relatively long distances between stops. Coaches shall be able to maintain a minimum of 10 MPH on a fifteen percent (15%) grade when loaded to GVWR.
- e. Scheduled maintenance tasks shall be related and shall be grouped in maximum mileage intervals. Routine scheduled maintenance actions, such as filter replacement and adjustments, shall not be required at intervals of less than 6,000 miles, except for routine daily service performed during the fueling operations. Higher levels of scheduled maintenance tasks shall occur at even multiples of mileages for lower level tasks.
- f. The bus, at GVWR and under static conditions, shall not exhibit deformation or deflection that impairs operation of doors, windows or other mechanical elements. Static conditions include the vehicle at rest with any wheel or dual set of wheels in a six-inch deep hole or with any one tire or any dual set completely deflated.
- g. All failures involving basic body, structure, axles and suspension are considered structurally related failures for purposes of this specification.
- h. The bus shall be new and unused, of current production model, with the latest design features. The unit shall be delivered fully operational and ready for revenue service with all necessary equipment and accessories.
- i. The low floor vehicle platforms are included in this specification and are generally described as 102" wide, low floor 30, 35, and 40 foot heavy-duty transit coaches. Approximate dimensions desired are as follows:

	30' Bus	35' Bus	40' Bus
Length - Over Body	30'	35'	40'
Width - Over Body	102"	102"	102"
Height (Tailpipe)	122"	122"	122"
Wheelbase	162.5"	230"	279"
Floor Height (Maximum)	16"	16"	16"
Rear Overhang (not to exceed)	8'	8'	8'
Floor Height	35"	35"	35"
Front Step Height (Maximum)	15.5"	15.5"	15.5"
Wheel Base	170"	219"	279"
Interior Headroom (Maximum)	95"	95"	95"
Aisle Width (Minimum)	26"	26"	26"
Door Width – Front (Clear)	34"	34"	34"
Curb Weight Max. GVW	21,800 lbs.	27,000 lbs.	27,600 lbs.
Vehicle GVWR	31,000 lbs.	39,600 lbs.	39,600 lbs.
Turning Radius (Front Body Corner - Maximum)	29.9'	36.8'	43.3'
Approach angle – Minimum	8.5°	8.5°	8.5°
Break-over angle	19°	12.8°	10.7°
Departure angle – Minimum	8.8°	8.8°	8.8°

4.2 Testing

- a. The vehicle provided shall be fully tested to assure compliance with the performance and safety requirements of the specifications. At the option of the SRTA, Bidder and/or CONTRACTOR may be required to provide test results and/or certifications insuring compliance with the requirements of the specifications. Certifications or written documentation outlining test procedures and results shall be prepared by a Professional Engineer and/or test laboratory certifying compliance with the requirements of the appropriate section of the technical specification and shall be provided by the Bidder and/or CONTRACTOR for approval by the SRTA.
- b. Contractor may be required to demonstrate compliance with any of the performance requirements of the technical specifications. Minimum testing that shall be required includes;
 1. Cooling System Performance
 2. AC Performance
 3. Acceleration
 4. Gradability
 5. Internal Noise
 6. External Noise
 7. Passenger Door(s) Opening and Closing Speed
 8. Lighting Levels
 9. Turning Radius
 10. Water Test

4.3 Internal Noise

- a. Maximum internal noise shall not exceed eighty (80) DBA in areas "1", "2", and "3", and no more than eighty-three (83) DBA in area "4" as described below. Sound levels within the coach shall be measured with all doors and windows closed and all vehicle equipment operating. If some equipment operates on a cyclic basis, the sound level shall be measured with all equipment functioning simultaneously to determine the worst case noise level.
- b. Measurements shall be made with the vehicle empty, except for test personnel and equipment. Not more than three (3) persons shall occupy the vehicle during the measurements.
- c. Measurements shall be made at a height of four feet (4') above the floor and directly above the center line of the seats at the following locations:
 1. The operator's seat;
 2. The foremost passenger seat at the centerline of the coach;
 3. The seat nearest the center of the coach, and at the coach centerline; and
 4. The rear-most seat at the centerline of the coach.
- d. Accelerate the coach at full throttle from standstill to automatic transmission shift speed. Gear or range must be selected so that

terminating test speed is sixty-five (65) miles per hour. Observe and record maximum sound level during this operating mode. The sound level recorded shall be the average of at least four (4) readings.

- e. Measurements shall be taken where there are no reflecting or absorbing surfaces to change the sounds emitting from the vehicle.

4.4 External Noise

Airborne noise generated by the coach and measured from either side shall not exceed 83 DBA under full power acceleration when operated at or below 35 mph at curb weight and just prior to transmission upshift. The maximum noise level generated by the coach pulling away from a stop at full power shall not exceed 83 DBA. The coach 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. All noise readings shall be taken 50 feet from the perpendicular to the centerline of the coach with all accessories operating. Instrumentation, test sites, and other general requirements shall be in accordance with SAE Standard J366. The pull-away test shall begin with the front bumper even with the microphone. The curb idle test shall be conducted with the rear bumper even with the microphone.

5. **CRASHWORTHINESS**

- a. The coach body and roof structure shall withstand a static load equal to 150 percent of the curb weight evenly distributed on the roof with no more than a 6 inch reduction in any interior dimension. Windows shall remain in place and shall not open under such a load.
- b. The coach shall withstand a 25 mph impact by a 4,000 pound post-1973 American automobile at any point, excluding doorways, along either side of the coach with no more than 3 inches of permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the coach interior.
- c. Exterior panels and their supporting members shall withstand a static load of 2,000 pounds applied perpendicular to the coach anywhere by a pad no larger than 5 inches square. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the coach.
- d. The coach, at GVWR and under static conditions, shall not exhibit deformation or deflection that impairs operation of doors, windows, or other mechanical elements. Static conditions include the vehicle at rest with any one wheel or dual set of wheels on a 6 inch curb or in a 6 inch deep hole.
- e. 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.
- f. To protect passengers seated in low floor area, the basic low floor coach structure shall incorporate a substantial side impact barrier. The barrier shall include steel plate, continuous between the front wheel arches and the rear suspension (except in the width of the exit door opening). The impact barrier shall be an integral welded part of the undercarriage portion of the coach structure, and shall be angled such that vehicles impacting the coach side will tend to subvert. To further increase both passenger safety

and repairability, robust welded structures are required between the angled barrier and the coach side skins. These shall be designed to dissipate collision energy.

6. MATERIALS

- a. All materials used in construction of the coach and all its parts shall conform in all respects to American Society of Testing Materials, Society of Automotive Engineers, or similar association standards. Materials used shall be exactly duplicate in manufacture, design and construction on each coach model.
- b. Reinforced fiberglass and plastic materials shall be excluded from the basic body construction, except for replaceable panels, doors, and front and rear caps.
- c. All lumber shall be thoroughly kiln dried free from knots and checks and shall be of clear straight grain, dressed on all sides.
- d. All painted aluminum sheets shall be thoroughly cleaned and coated on the outside with PPG, or approved equal, DPU low VOC protective paint prior to assembly in coach.
- e. All joints shall be protected by application of zinc-chromated metallic compound, Butyl Tape Sealer at assembly.
- f. Plywood shall be of a marine grade with sealed waterproof edges.
- g. All bolts, nuts, washers and exposed linkage shall be zinc, cadmium plated or phosphate coated to prevent corrosion.
- h. All bolts, nuts, and washers shall be Domestic manufacture and be SAE Grade 5 or better.

7. CORROSION/UNDERCOATING

- a. The vehicle shall resist corrosion from atmospheric conditions and road salts. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, provided it is maintained in accordance with the procedures specified in the manufacturer's service manual by the SRTA. Materials exposed to the elements and all joints and connections of dissimilar metals (and remote from each other in the galvanic series), shall be corrosion-resistant and shall be protected from galvanic corrosion.
- b. The entire body frame assembly, access doors, fenders, cab, underbody, wheelhousings, lower skirt panels, including closed-off body panel sections, and all welds shall be treated and rust-proofed with a commercial grade heavy-duty rust-proofing material. All metal body parts shall be given a thorough multiple-stage anti-corrosion treatment. The product used shall be listed as a qualified product under Mil Spec C-62218, Mil Spec C-0083933A (MR). Zinc chromate or zinc phosphate prime paint shall be applied to both aluminum and steel. Body panels that are aluminum or tin coated, etc., or treated in any other method or procedure currently accepted by the commercial vehicle industry, are acknowledged as meeting this requirement and need no further treatment, except for finish prime/paint or undercoating where applicable. Representative samples shall withstand a 2-week salt spray test in accordance with ASTM Procedure B-117 with no visual or structural detrimental effects to normally visible surfaces, and no significant structural degradation or weight loss of over 1 percent (1%) for other members or components.

- c. Except as noted below, the entire body lower frame assembly, cab, underbody, understructure/frame, chassis, fenders, wheelhousings, and lower skirt panels shall be completely undercoated with a silver or light grey colored undercoating.
- d. Undercoating shall be composed of a non-volatile/non-flammable resin-type base, grit and abrasive free material, dispersed in a petroleum solvent, providing a homogenous formulation, MIL-TD specification grade undercoating material. Undercoating shall be applied to a uniform thickness throughout with no bare spots. Bidder shall indicate methods to be used in meeting this requirement.
- e. Items and components that shall not be undercoated include non-metallic fender and stepwells, engine, transmission, driveshaft(s), differential/axle housing, brakes, lube fittings, exhaust system, and power steering heat shields.

8. UNDERCARRIAGE

Both front and rear axles shall have the load rating for the gross loads equal to or greater than the coach builder requires them to carry. The gross load shall include curb weight plus seated and standee passengers with the average weight of each passenger to be 150 pounds. Front and rear axles for the coaches shall have the highest GVWR capacity available. Front and rear hubs shall be of steel construction.

8.1 Front Axle

- a. Front axle shall be a Rockwell – Meritor, or approved equal, heavy-duty standard axle designed with proper wheel and axle geometry so that imperfect front axle operation will not be encountered in service.
- b. Front axle shall be 14,600 lbs., minimum rating or be rated for the loads the bus builder's design requires.
- c. Wheel bearings shall utilize oil seal type lubrication.

8.2 Rear Axle

- a. Rear axle shall be a Rockwell – Merito, or approved equal, standard single reduction axle with a minimum rated capacity of 26,000 lbs (21,000 lbs for 30 foot coach).
- b. The rear axle shall be a heavy-duty, full floating type, Meritor Standard, incorporating a spiral bevel drive, or approved equal. The axle housing shall be a steel stamping and located to the roadside of the axle center. The load tubes shall be fixed and the wheel bearings oil lubricated. The housing drain plug shall be magnetic.
- c. The differential carrier shall incorporate the differential assembly, drive pinion and pinion cage. Carrier shall be removable as a complete unit from the axle housing.
- d. The four (4) pinion differential gears shall be carried in a two-piece case mounted on tapered roller bearings. Torque nuts and bolts are used to mount the dowel gear drive to the flanged half of the differential case.

- e. Axle shafts shall be the floating type with all wheel bearing loads carried on the axle housing end sleeves.
- f. The drive flanges at the outer end shall be attached to wheel hubs by studs, nuts and tapered dowels. Axle hubs shall be stud wheel pilot mounting.
- g. Wheel bearings shall utilize "wet" lubrication.

8.3 Rear Axle Gear Ratio

The differential gear ratio is subject to approval by the SRTA prior to production after reviewing computer generated performance scans for the buses offered.

8.4 Hubodometer

An Engler (Stemco) Hubodometer "million mile" (no tenths), or approved equal, shall be installed with the correct bracket on curbside rear axle flange studs.

8.5 Wheels and Tires

- a. The coach shall be equipped with single front and dual rear wheels. Front wheels and tires shall be balanced and counter weighted where necessary. Alcoa Aluminum wheels (p/n 883110DB) with "Dura-Brite" surface treatment, 8.25 x 22.5, satin machine finished stud (budd) piloted wheels, or approved equal, shall be provided. Steel wheels may be an alternative to aluminum wheels with color being specified by individual RTA. Two spare wheels per bus shall be provided.
- b. Tires shall be furnished by the SRTA, via its leased tire contractor at the time of vehicle delivery. All low floor coaches shall be capable of using standard size 12R22.5 or equivalent mileage tires, except the 30 foot low floor which shall be able to use 275/70R x 22.5.

8.6 Air Suspension

- a. Coach shall be equipped with an air-suspension system. Air suspension system shall consist of four (4) rear and four (4) front Rolling Lobe Firestone air bellows and three (3) leveling valves as manufactured by Delco, or approved equal, by which the air pressure is automatically regulated in proportion to the coach loading. Leveling valve shall be installed in such a manner that will prevent leveling valve roll-over.
- b. Air bellows shall act as a flexible connection between body and axle to absorb and cushion road shocks.
- c. Leveling valves manufactured by Barksdale, or approved equal, shall also act to keep the coach body in relatively level position and contain a dampening or compensating feature to prevent excessive consumption of air resulting from high-frequency axle movements over rough streets.
- d. Metal air chambers, if used, shall be guaranteed by the manufacturer for the life of the coach. Methods of construction and the materials used shall be of such manufacture as to permit easy and convenient replacement of bellows. Bellows shall be mounted to provide easy replacement under coach.

- e. The three (3) Barksdale, or approved equal, height control valves, one (1) at the front axle and two (2) at the rear axle, will retain the height of the body in relation to the axles under all loading conditions.
- f. Each axle shall have front radius rods manufactured by Clevite, or approved equal, and rear radius rods manufactured by O&S, or approved equal.
- g. Two (2) lower, one (1) upper, and one (1) lateral to locate the axle position and to transmit the driving, braking and cornering forces from the road to the coach understructure.
- h. The front upper radius arm assembly shall have a turn buckle to allow adjustment of the front axle caster without arm removal.
- i. Shock absorbers, Koni adjustable, or approved equal, shall be provided.
- j. Rubber axle stops shall be provided between the axle and frame on each side of the axles to prevent axle and/or frame damage in severe bounce condition and to allow operation of the coach if one or more air bellows are deflated.

8.7 Steering System

- a. Power steering shall be Ross Model TAS6505, or approved equal. Steering column shall be TRW Electric assist without column turn signal and hazard switch, or approved equal.
- b. Steering effort and number of turns "lock-to-lock" shall be designed and coordinated to minimize driver fatigue. Steering forces and characteristics in the event of failure of the power boost shall enable the coach to be safely driven in this condition.
- c. Steering mechanism shall be mounted so that all adjustments can be made without dismounting parts. Mounting of gear assembly shall be engineered to reduce road shock and vibration.
- d. Steering units shall have hex head filler and drain plugs.
- e. The drag link assembly shall have a horizontal socket for attachment at the Pitman arm, and a vertical stud for attachment at the steering knuckle arm. Both ends shall have internal springs and lubrication fittings. The assembly shall have plus or minus .50-inch length adjustment.
- f. Front axle tie rod ends shall be threaded into the tube for adjustment without removal. Lubrication fittings shall be provided on the nonserviceable end assemblies.
- g. The steering wheel shall be twenty inches (20") minimum in diameter and shall be black color plastic or synthetic resin construction with a metal core. It shall be provided with puller holes in the hub.
- h. Shall be tilt with telescoping steering shaft.

9. **BRAKES**

9.1 General

- a. The vehicle's air brake system will be equipped with both service and emergency brakes that conform with FMVSS 121 as applicable. An Anti-lock Brake System operating in conjunction with the air brake system shall be standard with each coach. Prior to delivery of the first coach, the Contractor shall supply documentation certifying the air brake system conforms to FMVSS 121/. If the contractor has no documentation certifying that the vehicles furnished under this contract conforms with FMVSS 121, the SRTA shall require the manufacturer to perform stopping tests on one (1) coach at full G.V.W.R. and measure stopping distances, in accordance with FMVSS 121. The test shall be completed prior to delivery of any coaches to the SRTA. If the test vehicle fails any portion of the testing, the vehicle will be re-tested after modifications until all tests are successfully completed.
- b. A dual brake system shall be provided in the coach which provides two totally independent brake systems. This system features a dual brake valve in which the top portion provides the primary service brake system. In the event of a loss of air of one system, the other system will provide adequate braking to stop the coach. A Bendix-Westinghouse "SR-1" spring brake control valve, or approved equal, shall be provided to modulate rear spring brakes in the case of a primary system failure. The service brakes shall consist of four (4) wheel air operated, internal expanding S-Cam type.

9.2 Brake Chambers

- a. Brake chambers shall be MGM type, or approved equal, with protective boot over the push rod.
- b. Brake chambers shall be equipped with manufacturer's standard diaphragm and spring. Brake system shall be balanced to provide safe stop operation.

9.3 Service Brakes

- a. Coaches shall be equipped with brake systems which conform to the requirements of all Federal regulations, designed so such conformance can be maintained throughout the normal adjustment cycle. A supplemental brake (transmission retarder) shall also be provided. The supplemental braking shall not be used in meeting regulatory criteria. The braking system shall include service brakes, a parking and emergency brake.
- b. The driver's brake pedal shall control the service brake and the supplemental brake in a coordinated manner to give a total braking effort depending on the position of the pedal up to the maximum capability of the braking system. Brake valve shall be a Bendix-Westinghouse or approved equal, brake to minimize brake fade and to achieve maximum brake lining lifetimes. Braking forces shall be proportioned among the axles to assure balanced braking and equalize lining life between axles.

- c. Brake lights shall be activated as soon as the brake pedal is depressed and when any auxiliary braking (transmission retarder) is applied.
- d. The parking brake shall be a spring brake MGM #E3636T, or approved equal, with quick release yoke or manual "wind-off", capable of bringing the coach to a stop from a speed of twenty (20) miles per hour at a deceleration rate equivalent to a stop within sixty feet (60') with a seated passenger load. The parking brake shall be actuated and exhausted by a manual "push-pull" valve. The valve shall apply the brakes by pushing "in" and release the brakes by pulling "out." In the event of total loss of air system pressure, the spring brakes shall be applied automatically. The control valve shall be located to the left and adjacent to the driver for safe, convenient access.

9.4 Brake Interlock

The primary service brake system shall incorporate a double check valve, pressure regulator and a solenoid valve to provide a rear brake and throttle interlock while the rear door of the coach is open. Release occurs when the rear door is closed and the Operator's control is deactivated. Also, the actuation must occur when kneeling and/or wheelchair lift is used in conjunction with the front door. The front door operation shall not be interlocked with the brake system.

9.5 Brake Drums, Shoes and Linings

- a. Rear brake drums shall be a minimum of 14.5 by 10 inches. Front brake drums shall be a minimum of 14.5 by 6 inches. Brake shoes shall be of two shoe type, heavy duty, fabricated steel, heavily ribbed to insure uniform pressure. Linings shall be non-asbestos heavy-duty transit brake block manufactured by Meritor, or approved equal. A method of visually indicating wear of the brake lining shall be provided. 'S'-cam brakes shall be supplied. Drums shall be labeled with the maximum safe diameter for drum refinishing.
- b. Brakes shall be provided with "Haldex", or approved equal, automatic slack adjusters. All slack adjusters shall be removable without disassembly or removal of other components and equipped with grease fittings for lubrication. Slack adjuster travel and geometry shall be designed not to exceed 90 degrees in relation to the pushrod, when properly adjusted, throughout the lining life.

9.6 Brake Hoses

All brake hoses shall be installed in locations where the possibility of damage is minimized. Hoses shall be clamped and supported by the coach structure to minimize long unsupported hose lengths and to eliminate rubbing and/or chafing.

9.7 Brake Retarder

- a. Transmission shall have an integral brake retarder.
- b. Retarder ON-OFF Toggle switch shall be mounted in the driver's console area, location to be approved by the SRTA. Switch to be labeled "RETARDER" and with ON, OFF lettering for appropriate switch position.

10. **AIR SYSTEM**

10.1 Air Compressor

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- a. Air compressor shall be a Wabco, or approved equal, sized by the bus manufacturer for the air system requirements and duty cycle of the bus.
- b. Compressor shall be gear driven by the engine. The compressor shall be equipped with an inlet check valve to minimize the blow by of oil through the compressor.
- c. Air Governor shall be Bendix-Westinghouse "D-2" type, or approved equal.
- d. Discharge line from the compressor to the air dryer and first tank shall be not less than seven-eighths inches (7/8") inside diameter of stainless steel braided construction with teflon inner liner. The discharge line will be properly supported to prevent chafing or damage and routed to insure the line will drain to the first tank/dryer.

10.2 Air Tanks

- a. Air reservoirs shall be of adequate capacity for supplying the air volume needs of the coach. All air tanks shall be equipped with four (4) drain valves mounted on the road side, and have pull cords at lower skirt curbside.
- b. There shall be low-air pressure switches located on the air tanks. They shall monitor the primary and secondary reservoir air pressure.
- c. In combination with the visual and audible signals, there shall be a single "VDO", or approved equal, dual needle air pressure gauges reading the pressures of the primary (rear brake) and secondary (front brake) reservoirs.
- d. All air lines shall be synflex nylon tubing, color coded, meeting the requirements of SAE type J844, except for the supply lines, which shall be 2807 stainless steel braid.

10.3 Air Dyer

The air system shall be equipped with a SKF, HCT-2000 Duraguard air dryer, or approved equal, mounted in a location approved by the manufacturer and reviewed with the SRTA during the pre- production meeting.

10.4 Brake Lines Body Mounted

- a. All air lines shall be synflex nylon tubing, color coded meeting the requirements of SAE type J844. The supply lines shall be 2807 stainless steel braid, Teflon inner core for heat resistant. Lines shall be securely mounted to frame to prevent chafing or wear. Clamps shall be of proper size. Lines shall be protected at clamps with heat resistant material.
- b. Rubber grommets shall be used at all points where air lines pass through bulkheads or any supports.

- c. All clamps, fittings, etc., must be easily accessible and installed in such a manner that they are easily removed and replaced.

10.5 Brake Lines at Wheels

Flexible brake lines shall be Parker Hannifin Model 293 with nut and sleeve type fittings, or approved equal. They shall be of adequate length to prevent any strain, regardless of relative motion between brake valve and brake chamber, without allowing chafing or rubbing.

10.6 Brake Relay Valve

A brake relay valve shall be provided. It shall be Bendix-Westinghouse R-12, or approved equal.

10.7 Check Valve

A check valve shall be provided between #1 and #2 tanks, adjacent to the second tank, and accessible for service.

10.8 Interlock Valves, Door, Accelerator and Brake

Door, accelerator and rear brake interlock valves shall be mounted to minimize length of air lines. Location to be approved by the SRTA.

10.9 Towing-Air Line Connector

An air line connector (Shrader, or approved equal) shall be installed on the front and rear end of the coach. Final installation locations shall be approved by the SRTA.

10.10 Switch, Low Air Pressure

The switches shall be connected in parallel and shall trigger a red indicator "LOW AIR" light and an audible alarm when the air pressure of any reservoir is below 90 p.s.i.

11. **PROPULSION SYSTEM**

The powerplant 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 powerplant. Two mechanics shall be able to remove, replace, and prepare the engine and transmission assembly for service in less than 20 total combined man hours. The muffler, exhaust system, air cleaner, air compressor, starter, alternator, radiator, all accessories, and any other component requiring service or replacement shall also be easily removable independent of the engine and transmission removal.

11.1 Engine

- a. Coach shall be powered by a Cummins ISL heavy-duty diesel engine with a minimum 280BHP, 2200 RPM peak torque of 900 foot lbs., 1300 RPM, or approved equal.
- b. Power plant shall be a complete unit, mountable and demountable unit installed in the "T" or in-line configuration. The engine installation shall include motor mounts and related accessories that provide proper vibration isolation and

control of engine movement in all axis to prevent premature wear and failure of engine accessories, drive belts, piping, hoses and related hardware

- c. Engine shall meet all applicable Federal and State clean air standards as they pertain to diesel engines.
- d. The rear mounts for the engine shall be attached to engine bell housing.
- e. All accessories, other than the air conditioning compressor and one (1) other component, shall be driven from engine without use of drive belts or chains. A maximum of two (2) belt driven accessories shall be accepted.
- f. The engine installation shall contain the latest available specific provision for emission and sound control per State/Federal regulations for the year the coach is delivered. The installation must meet the requirements as established under Section 4.3 "Internal Noise" and Section 4.4 "External Noise" of these technical specifications.
- g. Fleetguard spin-on oil filter, or approved equal, shall be mounted to the engine.
- h. A Spinner II, model 76 transit by-pass filter, or approved equal, shall be provided and mounted in an easily accessible area. Use of this system and the installation design shall be authorized by the engine manufacturer.
- i. The oil filler tube and oil dipstick shall be accessible through the engine compartment door. Both shall be readily accessible without the removal of belt guards for engine servicing.

11.2 Engine Protection

- a. The engine shall be protected from failures by the electronic module and sensors consisting of no less than "Low Coolant", Low Oil Pressure, and "Oil Over-Temperature", "Coolant Over-Temperature" will provide information to the control module regarding the engine's condition.
- b. Once a signal is received from a sensor, the engine control module will provide the Operator with "Check Engine" and "Stop Engine" lights and alarm at the dash board area. In addition, a code associated with the detected problem is stored in the Engine Control Module memory.
- c. When the two (2) lights are illuminated, the Engine Control Module cuts power back. Thirty (30) seconds after fault detection, the engine is cut off completely.
- d. A momentary type stop engine override button will be provided, which enables the Operator to receive another thirty (30) seconds of operation before shut-down.
- e. The Engine Control Module shall be equipped with a self diagnostic system as well as engine system protection and engine performance diagnostics. A failure shall be retained by the control module for evaluation by garage personnel using a diagnostic reader.
- f. The Engine Control Module shall be remote mounted to allow easy access to service and diagnose the ECM.

- g. There shall be a total of two (2) plug-ins for the diagnostic reader, one (1) to be located at the Operator's dash area and the second (2nd) to be located at the rear engine run control box. Both plugs shall be permanently affixed to the coach for ease of plug-in. The rear connectors shall be mounted at the rear run control box within a sealed, weatherproof enclosure.

11.3 Engine Throttle Systems

- a. Accelerator shall be Williams with a 45° angle compatible with transmission, and electronic engine, or approved equal. The throttle pedal shall be mounted so that it is equal to or higher than brake pedal. Adjustable throttle and brake pedal are to be included.
- b. The engine shall be equipped with a fast idle device to be automatically engaged with the transmission in neutral and the air conditioning system and/or wheelchair lift in operation. Such a device may also be manually activated any time the bus is in "Neutral" by the Operator.
- c. The engine compartment shall be equipped with a Morse Electronic Power Take-off Speed control, part number 305662, or approved equal. Such a throttle shall enable the service personnel to manually "throttle up", "throttle down", or maintain infinite levels of engine RPM's by use of a twist and lock control. The Throttle control shall be mounted at the rear run control box. The system shall be controlled by a "Front/Rear" sealed selector switch located on the rear run box. When the switch is in the "Front" mode, the manual throttle shall not operate. The switch shall be guarded with a non-rotational cover.

11.4 Air Cleaner

- a. The air cleaner shall be a Donaldson Model RBX00-2277 click-stop air restriction indicator calibrated for the inches of water/vacuum recommended by the engine manufacturer, or approved equal.
- b. The engine air intake duct shall be so shaped as to minimize water entrance into the air induction system, and the element shall be easily replaceable. A passage shall be provided so that any water which does find entry into the system can be drained prior to entry into the air cleaner element.

11.5 Engine Compartment Lines

Flexible lines (air, fuel and oil) in the engine compartment, shall be FC300 Aero Quip, or approved equal, with reusable fittings. Water lines in the engine compartment are silicone. The supply line on the hydraulic reservoir shall be a #20 Aero Quip, or approved equal, heavy duty braided hose. The hydraulic pump output hose shall be Aero Quip #444 high pressure hose, or approved equal. All lines shall be sufficiently secured so that there will be no abrasive movement.

11.6 Clamps

All support clamps in the engine compartment and/or on the power module that have direct contact with the wire, cable, harness hose or line shall be stainless steel Breeze clamps, or approved equal.

11.7 Insulation

Engine side of rear seat shall be sealed so as to prevent smoke and fumes from entering

passenger area and shall be insulated against both heat and sound. Thermal insulation shall assure there will be a minimum eighty degree (80°) temperature differential between engine compartment and passenger area

11.8 Fuel System

- a. The fuel tank shall be a single transverse mounted stainless steel fuel tank 120 gallon capacity with a usable capacity of 115 gallons. The tank shall be mounted under floor aft of the rear door and caged within the coach structure for safety and corrosion resistance.
- b. Tank shall be equipped with an audible signal to indicate when tank is almost full. Shall be equipped with Emco Wheaton Posi/Lock 105 with dry break, and shall be provided with hinged spring loaded "Posisnap" P/N 5797511 cap and hinged access door, or approved equal. Fill rate shall be a minimum of 40 gallons per minute. Filler neck shall be located on the curb side of the coach.
- c. The fuel tank shall be a bottom draw design, and the fuel tank sending unit is accessible from underneath the coach.
- d. The fuel tank shall be designed so as to not permit the spillage of any fuel, with the filler cap properly closed, when the floor of the coach is at any angle from horizontal through 22 degrees from horizontal in any direction for any period of time. This shall be accomplished with the fuel tank filled to capacity as defined by published capacity and whistle cut off point.
- e. Fittings on fuel and oil lines shall be SAE flared or inverted flare type. Fuel filter and lines shall be installed in such a manner as to avoid excessive heat and fire hazard. Restriction fittings, if applicable, shall be in fuel return line and of proper size so as to maintain fuel pressure under all conditions. A swing type check valve in the fuel supply line shall keep the supply line full of fuel when servicing filters or when fuel lines are disconnected in engine compartment.
- f. One (1) DAVCO 384 heated remote mount fuel, or approved equal, filter shall be provide in a location to be approved by the SRTA.
- g. Fuel lines in engine compartment shall be Aero Quip FC350 hose, black, or approved equal, for the supply and return fuel lines from the engine compartment bulkhead to the fuel tank.
- h. Underbody fuel lines shall be stainless steel braided Teflon. Lines shall be sized to meet the requirements of the engine manufacturer.

11.9 Exhaust System

- a. The exhaust muffler shall be a stainless steel heavy plate type muffler designed with proper acoustical qualities and tailored to the engine requirements and installation.
- b. Exhaust pipes shall be constructed of stainless steel metal tubing direct from the muffler to a location in the upper left rear of the vehicle.

- c. The exhaust system will meet all clean air standards, USEPA in effect for the model year bus offered.
- d. Exhaust system shall be constructed so that it will not cause back pressure in the engine or damage to the paint on the coach, and shall be anchored as near the end of the exhaust line as possible. It shall be mounted so as to maintain the integrity of its design throughout the life of the coach.
- e. Exhaust manifolds, muffler and single tail pipe assemblies shall be tight and allow no emission of fumes or smoke other than from open end of tail pipe.
- f. Access to test port on muffler shall be provided.
- g. Exhaust tail pipes shall be constructed of stainless steel tubing. The use of the vertical exhaust outlet shall not increase the overall length of the vehicle, nor shall it be located in such a way as to present a burn hazard to the pedestrian traffic. The termination of the tail pipe shall be such that it complies with FMVSS 108 pertaining to side marker and clearance lights, and exhaust shall be deflected to the left rear of the coach.

11.10 Transmission

- a. Automatic transmission shall be a Voith four-speed, or approved equal, compatible with the engine offered. An access panel through the bus floor to access the top of the transmission shall be provided. The access cover shall be covered with RCA flooring material, or approved equal, and trimmed with stainless steel. Fasteners shall be heavy-duty stainless steel with captive mating fasteners located in the steel floor structure.
- b. The transmissions shall be equipped with a hydraulic converter start, a hydraulic type retarder, and the latest electronic controls. A low profile cast aluminum pan shall be provided for maximum clearance. The retarder calibration shall be confirmed during the pre-manufacturing meeting.
- c. Transmission shall have a built-in oil pump, governor, and an external heat exchanger that utilizes water from the engine cooling system. The heat exchanger shall be located in an accident-free area.
- d. The installation design shall allow for separate removal of the transmission without removal of the engine. Engine supports and mounts shall not be located on the transmission to allow for easy transmission removal.
- d. A drain plug of magnetic type, and a flat magnet attached to bottom of oil pan near drain opening, shall be furnished.
- e. Transmission shall have a spin-on type external oil filter on both the main pressure valve body input line and the oil cooler output or return line.
- f. The retarder to have an On-Off switch mounted in overhead electrical compartment.

11.11 Transmission Controls

- a. The transmission shall be governed by electronic controls, which contain a programmable read-only memory (PROM) that will provide basic transmission

control function. The transmission electronic module shall be capable of communicating with the engine electronic module to maintain maximum efficiency.

- b. The gear selector shall be totally electronic with touch-sensitive pads compatible with transmission, located on left side console, and Voith approved, or approved equal.
- c. Transmission engine interlock switch will be provided so coach cannot be shut off while in gear. A starter lockout switch shall be provided that shall sense transmission gear changes. Starter motor shall be energized only with the transmission in the neutral position
- d. A waterproof back-up light switch shall be provided on the transmission to energize the back-up lights and de-energize the interior lights with transmission in reverse and master switch in the "RUN" or "NIGHT" position.
- e. The transmission retarder shall be controlled by brake activated air pressure switches. The final retarder control design will be discussed and approved at the pre-manufacturing meeting.
- f. The system will incorporate various sensors which feed information regarding the shift selection, oil temperature, pressure, etc.
- g. The Operator will be provided with a "Check Transmission" and/or a "Do Not Shift" light and alarm located at the Operator's dash board.
- h. The electronic controls shall be equipped with a self-diagnostic system as well as transmission protection. A failure shall be retained by the control unit for evaluation by garage personnel by using a diagnostic reader.
- i. Plug-ins for the reader shall be through the same two (2) plug outlets as listed under Section 11.2.g "Engine Protection." If separate plugs are required, they shall be mounted in the same two locations as specified for the engine controls, unless an alternate location is approved by the SRTA.

11.12 Propellor Shaft and Driveline

- a. Propeller shaft shall be a Dana 1710 series, or approved equal,. It shall have a minimum diameter of four inches (4") and shall be constructed of steel. The universal joints shall be heavy duty. Shaft shall have a protector guard.
- b. A slip joint shall be placed at the transmission to compensate for vertical movement at the rear axle. Lubrication fittings shall be provided for the universal bearings and slip joint splines.

12. **COOLING SYSTEM**

12.1 Engine Cooling

The engine shall be cooled by a water-based, pressure type, cooling system that does not permit boiling or coolant loss during the operations described above. Engine thermostats shall be easily accessible for replacement. Shutoff valves shall allow filter replacement without coolant loss. Valves shall permit complete shutoff of lines for the heating and defroster units, and water booster pumps. The water boost pump shall be a long life brushless design. All low points in the water-based cooling

system shall be equipped with drain cocks. Air vent valves shall be fitted at high points in the cooling system unless it can be demonstrated that the system is self-purging.

EMP, or approved equal, electric fan cooling system is required. Electric fans shall be brushless, variable speed, reversible and have a corrosion resistant metal shroud with finger guards. The fans should provide electronic feedback control and have diagnostics capability through the standard SAE J1939 diagnostics port. The cooling system shall consist of multiple electric DC brushless pusher type variable speed fans with electronic feedback controls. Electric fan motor speeds shall have a minimum operating range of 0-5500 rpm with capability of manual or automatic reverse operation in order to assist in debris removal. The cooling system shall be equipped with a master controller with the following capabilities; automatically reduce fan speed when the vehicle stops to minimize noise at the curbside, communicate on the J1939 CAN data link with system diagnostic retorting via DM1 messaging, review and download data via a laptop with service tool software, capable of software and calibration updates, receive commands from the engine or transmission ECM, report fault codes by lighting a engine compartment LED flashing light, sense engine compartment temperature and activate fans if maximum temperature is exceeded, collect and store cooling system and vehicle performance histogram data. If fans lose communication with the engine or sensors they shall go into a default speed mode to avoid vehicle shutdown. This communication shall use the industry standard RP1210 compliant datalink adapters connected via the standard 9-pin diagnostic connector found in the engine compartment and interior of the bus. Independent diagnostic detection shall be capable of identifying specifically which fan, measured input parameter, or datalink input parameter is experiencing a fault condition. Report both active and previously active fault codes with the number of detections/occurrences, time of the first and most recent fault detection, and cumulative time the fault was active. Where electric fans are used for cooling there shall be ample field experience. As a minimum, 50 electric fan based cooling systems shall be in transit revenue generating operation for at least 2 years.

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

12.2 Radiator

The radiator, and charge air cooler if integrated, shall be of durable corrosion-resistant construction. Radiators with copper/brass construction shall be fitted with bolted-on removable tanks. Brazed aluminum radiators shall have welded cast tanks. Automotive crimped-on tanks are more susceptible to leaks and early failure, and shall not be used. The radiator shall be designed so a mechanic can gain access to a substantial portion of the side facing the engine for the purpose of cleaning the radiator in five minutes or less.

Radiators shall have a fin density 10 fins per inch or less and shall not have louvered/slit designs. These are more susceptible to clogging and deteriorating cooling performance over time and shall not be used. Radiators shall utilize a bar and plate design so they are robust and can be cleaned with high pressure spray wash.

For certain severe environments, a secondary cooler may be used to increase the ambient temperature capacity for a cooling system. The secondary cooler shall be remote mounted, but below the coolant surge tank. Air flow should be provided with brushless electric fans. If an application requires a boost pump to maintain coolant flow to the secondary cooler, a brushless electric water pump shall be used.

No heat producing components or climate control system components shall be mounted between the engine cooling air intake aperture and the radiator.

The radiator and charge air cooler shall be designed to withstand thermal fatigue and vibration associated with the installed configuration.

12.2.1 Baseline: Standard Requirement for Coolant Filtration

The engine cooling system shall be equipped with a properly sized water filter with a spin-on element and an automatic system for releasing supplemental coolant additives as needed to replenish and maintain protection properties.

12.2.2 Baseline: Standard Requirement for Cooling Fan Operation

The cooling fans shall be temperature controlled, allowing the engine to reach operating temperature quickly. The temperature-controlled fans shall not be driven when the coolant temperature falls below the minimum level recommended by the engine manufacturer. Electric fans should provide independent control of the engine coolant and charge-air temperatures.

12.3 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 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.

12.3.1 Engine and Charge Air Cooler Cooling System - Electric

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 manufactures cooling system requirements. The cooling system fan controls should independently sense the temperatures of the operating fluids and intake air and if either is above safe operating conditions the cooling fans should be engaged. The fan control system shall be designed with a fail safe mode of "fan on." The cooling system in new condition shall have an ambient capacity with vehicle at max. GVW of at least 115°F at Peak Power and 120°F at Peak Torque using a 50-50 mix of ethylene glycol/water at sea level operation. Vehicle might require the following recirculation control features; vented curbside door, vented rear door and/or radiator skirt.

12.4 Surge Tank Filler Neck and Cap

- a. The sealed cooling system shall be provided with self-unloading valve to prevent extreme pressure from injuring cooling system.
- b. Heavy-duty copper, brass (stress relieved), or stainless steel radiator surge tank shall be provided and mounted above the radiator and easily accessible for service. Sight glass shall be provided to allow check of fluid level without opening system. A low coolant sensor will be provided on the surge tank. Filler cap shall be hinged type.

- c. A spring-loaded, push-button type valve to safely release pressure or vacuum in the cooling system shall be provided. A "T" fitting shall be installed prior to the valve to allow pressure testing of the system. The valve and water filler shall be located no more than sixty inches (60") above the ground and be accessible through the same access door as the sight glass.

12.5 Water Pump

Water pump shall have sufficient capacity to prevent any hot spots under all operating conditions.

12.6 Hose/Clamps

Engine water and heater hoses shall be premium quality Armet or Flex-Fab silicon hose, or approved equal. All hoses shall be protected from engine heat which may cause premature failure. All hose clamps shall have constant tension. Hose clamps shall be 1/2 inch wide minimum, stainless steel worm type, socket tightened with collar (Breeze or Oetiker).

12.7 Water Filter

"Fleet Guard" spin-on water filter (no pre-charge type), or approved equal, with brass shut-off valves both inlet and outlet, shall be installed in an easily accessible area.

13. **FIRE DETECTION/SUPPRESSION SYSTEM**

A dry chemical, pre-engineered fire suppression system, AMEREX model #V-25, or approved equal, shall be furnished and installed for the protection of the coach. The system supplied shall be approved and listed for use at -65 F (-54 C) to +150 F (66 C) by Factory Mutual Research Corporation (FMRC). The automatic detection and actuation system shall provide twenty-four (24) hour fire detection of the engine compartment. The system shall be designed to operate at 12 to 24 VDC and shall not exceed a standby current draw of more than 0.1 amp. The system manufacturer shall provide a \$5 million insurance policy (per vehicle, per incident) to the SRTA. The inherent safety aspects provided by the suppression system requires the manufacturer of the related equipment to be an ISO 9000 registered company.

13.1 Agent Cylinders

- a. Agent Cylinder shall be of the stored pressure type minimum 25 pound capacity. The cylinders shall be constructed of welded steel and must conform to Department of Transportation (DOT) specification 4BW, and must be marked as such. The hydrostatic retest interval for these cylinders shall be 12 years minimum. Cylinders shall be modular, with each having its own discharge piping and nozzles. Operating pressure for the cylinders shall be 350 psig.
- b. A gauge, protected by a rust-resistant chrome plated brass gauge guard, shall be provided to indicate proper pressurization of agent cylinders. The agent cylinder shall be equipped with a forged brass valve assembly. This valve shall retain and release extinguishing agent and repellent pressure by means of a spring loaded sealing stem. The valve shall be configurable for actuation by a pneumatic control head. See "System Actuation." No replacement parts, such as burst discs, shall be required to recharge the agent cylinder following discharge.

13.2 Nozzles

- a. Nozzles shall be brass, and be of the design approved by FMRC for use with the vehicle suppression system specified herein. Nozzles shall be located to protect specific hazards as identified by the system installer and the equipment owner. All nozzles are to be fitted with dust caps that, upon system actuation, are displaced to allow full chemical flow. The caps are to be constructed so that upon displacement they do not drop into a fire hazard where they can contribute as fuel to an in-progress fire.
- b. Nozzles shall be of the type to provide both total flooding and local application coverage. Nozzle coverage shall be modular to provide a minimum single nozzle total flooding coverage of 244 cu. ft. or local application coverage of 900 sq. in. Nozzles shall be combined with appropriate agent cylinders to yield 4, 6, or 8 nozzle combinations. A minimum of four (4) nozzles shall be provided in the engine compartment.

13.3 Extinguishing Agent

The system shall use as its extinguishing agent ammonium phosphate base, multipurpose class ABC dry chemical. This agent shall be approved for use with the system specified herein by Factory Mutual Research Corporation. Extinguishing agents that are of known ozone depleting nature or are suspected carcinogens are not acceptable.

13.4 Hoses and Fittings

Fittings shall be galvanized malleable or ductile iron, black or galvanized steel, stainless steel, copper or brass. Cast iron fittings shall not be used. Hose shall be, at minimum, single wire braid, rubber hose conforming to and marked as SAE 100 R5 or SAE 100 R1.

13.5 System Actuation-Remote

Actuation of the agent cylinder valve(s) for distribution of the extinguishing chemical shall be accomplished by a pneumatic control head. Actuation pressure of the pneumatic control head shall be supplied by remote nitrogen cylinders independent of the agent expellant pressure. Release of nitrogen gas from the remote cylinders shall be accomplished by the manual striking of a palm button and, optionally, by the automatic firing of an electrically initiated gas generating cartridge (squib).

13.6 Fire Detection

Detection of fires shall be accomplished by devices approved for use by Factory Mutual Research Corporation as Heat Actuated Fire Detectors. The detectors shall be normally open and shall be capable of carrying sufficient amperage for the purposes of firing the gas generating cartridge (squib).

13.7 Suppression System Circuit Supervision

- a. An electrical circuit monitor (circuit monitor plus) shall be provided for the automatic suppression system. This circuit monitor shall provide electrical supervision of the automatic fire suppression system POWER, HEAT

DETECTION, and SYSTEM ACTUATION electrical wiring circuits and shall facilitate the connections of these circuits. The enclosure for the control shall be watertight and shall be electrically non-conductive. The circuit monitor shall be capable of either 12 or 24 VDC operation.

- b. The control shall provide indication of a NORMAL, FIRE or FAULT condition via red and green LED's mounted behind the control enclosure front panel. Once initiated, the circuit monitor shall remain in the FIRE or FAULT mode until the fire suppression system is returned to a ready condition. The red LED shall be clearly labeled "FIRE."
- c. The circuit monitor shall also be equipped with a continuous tone audible alarm. This alarm shall sound in both FIRE and FAULT conditions. Once the audible alarm begins to sound it shall be capable of being silenced by depressing a labeled ALARM SILENCE button, provided on the circuit monitor front panel. Indication of a silenced alarm shall be provided via a labeled SILENCED ENGAGED LED.

14. **ELECTRICAL**

The bus will be equipped with a dual voltage 24/12 V power distribution system, adequately sized for all electrical loads on the buses as specified, including air conditioning and wheelchair ramp. Design details of the electrical system will be reviewed with the SRTA during the pre-production meeting.

14.1 Alternator and Regulator

- a. The alternator shall be sized to supply the entire nighttime operating electrical load of the coach while providing at least 20 percent (20%) of its current output for battery charging when the battery is fully discharged. The alternator shall be an EMP P450, or approved equal, rated at 450 amps with an external electronic voltage regulator.
- b. The Contractor shall provide an analysis, approved by the SRTA, demonstrating that the alternator supplied is adequate for coach operation in the service area of the SRTA. Alternator cooling methods shall be approved by the SRTA.

14.2 Battery

- a. The term battery means two or more heavy duty top quality lead acid battery units mounted side by side in a battery compartment. The battery compartment shall not be located in the engine compartment. Pull-out stainless steel battery trays shall be provided. Batteries shall be by "DEKA", or approved equal. The configuration for the battery is two battery units size 8D, 12 volt, 6 cell and 31 plates per cell. Batteries shall be stamped with the date of manufacture. Batteries shall not be abused or quickcharged before delivery. Batteries shall be new when the coach is delivered to the SRTA.
- b. Despite the battery configuration stated above, the Contractor shall be responsible for analysis of the loads and selecting a battery of adequate capacity to supply them. Other battery configurations may be used with the prior approval of the SRTA. Battery installation to be approved by the SRTA.

14.3 Battery Terminals/Wiring/Protection

- a. The battery wiring shall be terminated with properly sized ring terminals. The batteries shall include 7/16" positive and 3/8" negative terminals. The cable shall be permanently marked with a "+" and "-" at the battery end. Cables shall be extra flexible and routed in the battery box so as not to chafe or rub on the battery tray and other components. Cables shall allow full slide-out of the tray. Cable ends shall be sealed to eliminate corrosion from battery acid and/or fumes. Cable ends shall be attached to the battery studs with non corroding flat washers, spring washers and brass nuts. Cable ends will be coated with a corrosion inhibitor after being attached to the batteries.
- b. A circuit breaker capable of interrupting a major short circuit shall be supplied on the positive side of the batteries. The breaker shall be located near the batteries in an easily accessible location, sealed from water and battery fumes.
- c. There shall be a set of battery jumper terminals located next to the battery electrical main switch and a set located in an easily accessible location in the engine compartment. Location and mounting of the terminals shall be approved by the SRTA.
- d. An electrical main switch shall be provided to positively disconnect the battery from electrical loads when the coach is not in use or in emergency situations. The switch shall be located in an outside compartment which requires no tool(s) for access. The switch shall be totally sealed in its own sub-compartment. It is preferred that the switch handle be non-removable. If the switch handle is removable, it shall be attached to the switch housing using a small corrosion proof metal cable. Emergency flasher and radio power circuitry shall be independent of the main switch. Exact location and details of the switch shall be approved by the SRTA at the design review.

14.4 Voltage Drop

- a. There shall be no more than a 3% volt cumulative drop on any circuit, measured from the initiating source to the appliance load positive and from the appliance load negative to the reference ground with the load fully operational.
- b. The initiating source for any 24 volt circuit is defined as the 24 volt output positive post of the series connected batteries.
- c. The initiating source for any 12 volt circuit is defined as the 12 volt output positive post of the battery equalizer/splitter.
- d. The reference ground is defined as the most negative post of the series connected batteries.
- e. Measurement equipment and procedure to check voltage drops shall be approved by the SRTA.

14.5 Starter

- a. The engine starter shall operate from normal coach voltage and be sized to provide sufficient torque to turn the engine reliably under all hot or cold engine or

ambient temperature conditions. The starter shall be a heavy duty "Delco Products Division" Model 42MT, or approved equal, as recommended by the engine manufacturer and approved by the SRTA.

- b. The starter solenoid switch shall be interlocked so that the engine can be started in neutral gear only with the transmission selector in neutral only. Starter will not operate when engine is running. The interlock shall be activated by fuel pressure or by other approved means. Other major electrical loads shall be disconnected while cranking.

14.6 Electrical Panel

- a. Circuit breakers shall be provided to sectionalize and protect all branch circuits of the electrical system of each coach. Any circuit without protection must be approved by the SRTA.
- b. To the maximum practical extent, electrical distribution and control devices shall be grouped on an electrical panel arranged for ease of access, test, and replacement of components. The panel shall be large enough to avoid crowding of the components and leads. Component heat build-up shall not affect the components or mounting locations. There shall be a test plug receptacle for electronically diagnosing the engine using portable instruments.
- c. A durable diagram shall be mounted, in the electrical panel, that identifies the components and their function. Relays and circuit breakers shall be permanently labeled to correspond to this diagram. Switch controlled lights shall be provided to illuminate the main electrical panel.
- d. The location, design, and arrangement of the panel and diagrams/labels shall be approved by the SRTA during the pre-production meeting.

14.7 Multi-Plex System Electrical

- a. The bus will be equipped with an I/O Controls Dinex multiplex control system, or approved equal, to minimize individual circuits and ease in troubleshooting electrical and component failures.
- b. The main coach controller (MBC/HCNC) shall be located at the rear electrical enclosure panel (rear bulkhead). Additional DIO's (Digital Input/Output Module) will be located above the exit door, air tank compartment, driver's console, and in the rear electrical enclosure panel. The indicator lamp strip module shall be integrated into the multiplexing system to receive commands from the master module to turn appropriate indicator lights on and off according to programming commands. The system shall be connected by a "ring loop" hookup.

14.8 Wiring

- a. All wiring including cables shall be stranded copper, adequate in size to carry the electrical load. Each harness shall contain identified spare wires (10 percent, minimum one) and shall be installed with consideration of possible future need to remove and replace it. All low voltage lighting shall run sufficiently cool so as to eliminate any damage to lamps, lenses, sockets, wiring or surrounding areas. Electrical junction boxes shall have sealed covers and openings.

- b. Wiring shall be insulated with two-layer cross-link polyethylene. Insulation must be moisture proof and heat resistant. It shall be a design objective to route wiring and harnesses in areas with no temperature build-up. If wiring must be run in areas of heat build-up, it must withstand, without deterioration for the life of the coach, the highest temperature in the area served. Engine compartment wiring shall be heat, oil and flame resistant. Alternative insulation materials for special installations may be used with the prior approval of the SRTA.
- c. Wiring shall be protected from weather and mechanical injury. Cables should be supported along their length and strain-relieved near terminations so that connectors and terminals are not under stress. Wire and cable passing through holes in sheet metal, structural members, etc. shall be protected with a grommet or other approved device. Wire and cable subject to flexing shall be extra flexible and shall be installed to allow for continual flexing without damage to the conductors or insulation. Wiring routed next to or bent over other materials shall be chafe protected by approved means.
- d. All under coach looms, cable runs, connectors, terminations and harnesses should be totally sealed to dirt, water and road hazards. Under coach wiring shall be run in sealed flexible plastic conduit. All under coach wiring protection methods shall be approved by the SRTA.
- e. All electrical connectors shall be replaceable. Engine and transmission harnesses shall have sealed, quick disconnect connectors to facilitate engine and transmission removal. All high current connection points shall be coated with approved conductive coating.
- f. All wire termination loops shall have a minimum of 2 inches excess wire for additional end terminal installation which will allow at least one replacement of the termination without disrupting the wiring harness. Wires shall not be spliced between terminations.
- g. Cable terminations shall be pressure-type terminals applied with a full cycle correct tool of the same manufacturer as the terminal. All terminals shall be full-ring, interlocking or tongue-type sized for the terminal screw or stud.
- h. All under coach connectors shall be of a locking type. A minimal number of spade terminals inside the bus is acceptable. Connector terminals shall be coated with approved dielectric grease. Drip loops shall be supplied on all under coach termination points.
- i. A description of all multiple pin connectors and the conductor identification scheme shall be submitted in advance of the pre-production meeting to the SRTA for review.
- j. All electronics components and boxes shall have quick disconnect plugs attached. Hard wiring to these boxes is prohibited.
- k. The conductor identification shall be developed by the Contractor to give an individual identifying designation to each wire for circuit tracing and renewal of equipment and shall be shown on all electrical diagrams. All junction panel terminals shall be numbered.

- l. All wiring shall be identified with hot stamped, machine printed wiring numbers printed on the insulation itself with no more than 6 inches of space between the identifying printed numbers along the continuous run of wire. Numbers shall not be removable by and be impervious to normal abrasion, oils, diesel, grease, Anti-Freeze, and water.
- m. Wire markers and/or any type of heat shrink shall not cover any termination point or crimped lug without SRTA approval.

14.9 Towing Connector

- a. An electrical receptacle shall be provided behind the front bumper of each coach, adjacent to the air connector described elsewhere in this section, to receive power for illuminating the tail lights, stop light, and directional signals from a towing vehicle.
- b. The receptacle shall be a 7-wire receptacle assembly "Cole-Hersee" No. 12063, or approved equal. The pins shall be coated with corrosion resistant paste. The termination end of the receptacle shall be strain relieved and sealed against water entry. Location, installation and pin wiring arrangement to be approved by the SRTA at the Pre- Production Meeting.

14.10 Farebox Wiring and Mounting

- a. Provisions shall be made for a 12-volt circuit for farebox operation and alarm. The supply shall be located in a weather proof junction box immediately under the farebox mounting area. A GFI farebox, or approved equal, wiring harness shall be supplied and installed from the under floor junction box the farebox mounting plate inside the bus. This harness shall be equipped with a GFI quick disconnect male plug to allow connection of the harness to the farebox.
- b. The manufacturer shall provide three (3) 16 gauge wires, (white, brown, yellow), loom covered, routed from a terminal strip in the radio box to the farebox junction box and to the farebox mounting plate inside the bus. A 2 inch (2") conduit will be installed between the farebox junction box under the floor and the radio box to allow data cables to be pulled to interface the farebox and radio system.
- c. A GFI mounting kit consisting of a mounting bolt and under floor ground strap shall be provided and installed on each bus. The ground strap shall be connected to the bus frame.

14.11 Radio Power Supply and Communications Cabling

- a. A separate electrical circuit, initiated at the batteries and terminating at the radio box shall be supplied. This circuit shall be independent of the electrical main switch, be capable of delivering 40 continuous amperes at 12 volts and be protected at the source with an adequate circuit breaker. No other electrical equipment shall be attached to this circuit. It shall be connected and placed to minimize electrical noise, hash and transients. If a 24 volt coach electrical system is used for the coach, an "Electric Transit Laboratories Inc. (ETL)" converter, or approved equal, shall be provided in the radio box to supply 12 volt power to the radio.
- b. Contractor is to install appropriate loom conduit and necessary radio accessories for later installation of radio and control head.

- c. An enclosed radio box with hinged, lockable cover will be installed behind the driver's seat in the interior of the vehicle. The box shall be sized for a Clever Devices Advanced Communication Radio (ACS) system, or approved equal.
- d. There shall be three (3) coded Number 12 wires from behind the dash to this compartment wired to a terminal strip. One wire shall be 12 volt at all times, one wire shall be 12 volt switched to the master run switch, and one wire shall supply a constant ground. The final details of this wiring shall be discussed by the Contractor and the SRTA's radio supplier at the pre-manufacturing meeting.
- e. Contractor is to supply and install standard coaxial antenna cable, RG A 58/U, or approved equal, housed in appropriate loom, connecting antenna with radio unit location. Loom installation shall permit future replacement of cable by "pull-through" method.
- f. Contractor is to supply and install radio antenna, Excalibur-450. Antenna, or approved equal, is to be located on the center line of the coach roof on a level section three foot (3') to four foot (4') from the front. An interior access panel shall be supplied to allow access to the underside of the antenna.
- g. A Covert Emergency Alarm button, or approved equal, will be installed for the operator's use in dangerous situations. The alarm will be integrated with the radio, audio listen-in microphone, the AVL and the CCTV. The proposer shall offer placement proposals and the SRTA will approve the location of the Covert Emergency Alarm button prior to the production build of the vehicles. Actual wiring from the covert button to the SRTA's ACS system will be done by the SRTA's radio contractor after delivery of the bus.

14.12 Console Assembly and Instrument Panel

- a. For ease of training and fleet commonality, the SRTA desires the instrument layout to be as similar as possible in the buses provided, with previous models in the SRTA's fleet. The bidders shall provide a front instrument and side console panel layout with their technical proposal, and indicate if optional layouts for components is available
- b. Side Console Assembly shall contain the following switches, all of which shall have lighted legends:
 - 1. Master Switch: 4-position rotary switch identified with lighted legend "Engine Stop," "Run," "Night" and "Park" marked on the panel, in accordance with FMVSS requirements.
 - 2. Engine Start: Push-button switch, marked "Start."
 - 3. Hazard Warning: 2-position On-Off toggle switch with lighted hazard symbol. Legend to be "Hazard" or symbol.
 - 4. Defroster: 3-position toggle switch having "Low-Off-High" positions. Legend to be "Defroster."
 - 5. Chime Switch: 2-position toggle switch having "On-Off" positions with legend "Chime."
 - 6. Farebox Light Switch: 2-position toggle switch having "On-Off" positions with legend "Farebox Light."

7. Fluorescent Light Switch: 3-position toggle switch having "All-Off-Rear" positions with legend "Interior Lights."
 8. Brake retarder: 2-position "On-Off" switch with the legend "Retarder" and "On-Off."
 9. Radio "Emergency Call" switch. No legend allowed. Locate in sidewall panel near driver's left knee position.
 10. Door control handle.
 11. Switch for fan for defrosting the windshield.
 12. Fire Suppression System Controls - The detection and fire suppression control console shall be mounted at the rear of the side console.
- c. Instrument Panel shall be manufacturer's standard for heavy-duty service, with clear lettering for identification. The instrument panel shall house the following controls:
1. Panel light dimmer: A rotary rheostat, labeled "Panel Lights", which controls the intensity of the panel and legend lights.
 2. Wiper control: An air control for each side, with lighted legend "Wiper", which controls the windshield wipers.
 3. The instrument panel shall contain, at a minimum, the following indicator lights:

Left Turn Signal	Exit Door Open
Right Turn Signal	Charging Failure*
Hot Engine	Brakes On
Low Engine Oil Pressure	High Beam Headlights
Low Air Pressure	Door Unlock Function
Fire Warning	Retarder
 4. Indicator lights shall be arranged across the top of the instrument panel. Location to be approved by the SRTA.
- *Charging Failure indicator light shall be on dash, also.
- d. Turn signal switches shall be located on the floor near the driver's left foot and shall be constructed with polarized multi-connector plugs.
- e. The instrument panel shall house the following monitor devices:
1. A dual-needle gauge that monitors air pressure in the front and rear brake reservoirs.
 2. Speedometer: A speedometer with MPH as major markings, 0-80 MPH.

14.13 Door Electrical

- a. Rear door shall be passenger actuated via touch bar door controls.
- b. Locking and unlocking of doors shall be controlled by a door-control handle located on the driver's console. Door control handle, when in the "rear" position, shall energize a solenoid that unlocks the door.
- c. A LED green lamp, which indicates that door is openable, shall be located above rear door. A red "EXIT DOOR OPEN" indicator lamp on driver's panel shall illuminate simultaneously with green lamp while door is open. Door control handle height and shape to be approved by the SRTA.
- d. A lamp mounted on the exterior, or door header above the front and the rear doors, shall be illuminated when the door is openable. Front and rear stepwell illumination lamps shall operate the same way. Lamps to be controlled by the master switch in the "Run" or "Night" position.

14.14 Engine Compartment and Rear Control Box

- a. The engine compartment shall have a rear control box with engine oil pressure and water temperature gauges. Gauges shall be mechanical. Control box will also contain two hour meters, one for the bus engine and one for the A/C system.
- b. The control box shall be located in the upper right corner of the engine compartment.
- c. Four (4) 21 c.p. incandescent lamps shall be installed in the engine compartment in locations which will provide maximum illumination for the mechanics.
- d. The engine and coach control switches on the face of the panel shall be as follows:
 1. Starter Switch - Three position toggle switch, marked "Front-Off-Rear" for selection of engine start position. Must be weatherproof.
 2. Light Switch - Two position toggle switch marked "Engine Compartment Lights." Must be weatherproof.
 3. Engine Start - Push button switch marked "Start", with waterproof rubber cover, shall operate the starter motor only when the starter switch is in the "Rear" position and transmission is in neutral. The engine transmission down link port shall be provided. Throttle control must be variable speed.
 4. Morse Throttle control, or approved equal - guarded selector switch for front-rear throttle control, plus Morse, or approved equal, manual throttle unit shall be mounted in the box.

14.15 Horn

Fiamm Technologies Inc. 12 volt horns dual electric horns, or approved equal shall be provided and mounted so as to be protected from road splash. Control shall be push button, located in center of steering wheel.

14.16 Backup Alarm

An electrical backup alarm producing an intermittent sound or a buzzer connected with backup lights shall be furnished. It shall be loud enough to be heard when the engine is running, yet not be too loud to annoy persons in their homes.

14.17 Exterior Lighting

- a. Exterior lighting shall conform to FMVSS and State requirements.
- b. Headlamps shall be dual, 12 volt LED's Dialight Headlights, or approved equal, shall be switched on with ignition switch. A dimmer switch shall be mounted on the floor between and above the turn signal switches. The instrument panel shall have a high beam indicator lamp.
- c. All clearance and I.D. lights shall be Dialight, or approved equal, surface or flush mount LED type. The units shall protrude not more than 1.5 inches when mounted on the vehicle. If a surface mount marker design is used, a custom guard to prevent damage to the light during contact shall protect the marker. All electrical connections to the LED light shall be by wire coming from the light housing and terminated with a Packard Weather Pak, or approved equal, connector. No interim connector shall be allowed on the body of the light. All lenses shall be smooth to prevent dirt entrapment and ease the washing process.
- d. Front directional signals shall have amber lenses and shall be located on the right and left front corner areas of the coach.
- e. Rear, tail, stop, backup and turn signal lamps shall be mounted on the right and left rear corner areas of the coach.
- f. A LED high mount brake light will be included which shall consist of two (2) Dialight, or approved equal, 4 inch red sealed lamps.
- g. Top lamps (turn) shall be amber Dialight, or approved equal, 4 inch diameter. The turn lights shall be fabricated with the use of a current regulator circuit to the LED's that allow for the operation of the device from 7 volts to 16 volts with constant intensity. All electrical connections to the LED light shall be by wire coming from the light housing and terminated with a Packard Weather Pak connector, or approved equal. No interim connector shall be allowed on the body of the light. All lenses shall be smooth to prevent dirt entrapment and ease the washing process. The entire LED assembly shall be specially coated to protect the light from chemical and abrasion degradation.
- h. Two (2) middle lamps (stop and tail) shall be red Dialight, or approved equal, 4 inch diameter. The stop/tail lights shall be fabricated with the use of a current regulator circuit to the LED's that allow for the operation of the device from 7 volts to 16 volts with constant intensity. All electrical connections to the LED light shall be by wire coming from the light housing and terminated with a Packard Weather Pak connector, or approved equal. No interim connector shall be allowed on the body of the light. All lenses shall be smooth to prevent dirt entrapment and ease the washing

process. The entire LED assembly shall be specially coated to protect the light from chemical and abrasion degradation.

- i. Bottom lamp (back-up lamp) shall be LED Dialight, or approved equal, with removable acrylic clear lens, replaceable 32 c.p. bulb number 1156.
- j. Side turn signal lamps shall be located on each side of the coach at the forward edge of the front wheel housing. The side signal lights shall be Dialight, or approved equal, amber 18 Series lights. These lights shall be guarded for protection. The light shall be visible from the rear and front of the coach as well as outward. All electrical connections to the LED light shall be by wire coming from the light housing and terminated with a Packard Weather Pak connector, or approved equal. No interim connector shall be allowed on the body of the light. The same type side signal lamp shall be located slightly above and slightly forward of the rear wheel housing.
- k. Intermediate side marker lights shall be Dialight LED Series 84, or approved equal, one on each side of coach.
- l. Wheelchair ramp/kneeling light shall be Dialight, or approved equal, LED 2 inch diameter located adjacent to the front entrance door.
- m. License plate lamp shall be Dialight, or approved equal, LED recessed in right lower quadrant of the engine compartment door.
- n. Curb Dialight, or approved equal, LED lights, or approved equal, shall be positioned in manufacturer's standard location above the front and rear doors in such a manner as to illuminate the ground area in the immediate vicinity of the stepwell. Dialight, or approved equal, LED lights shall be actuated when entrance door, exit door, or both, are opened.
- o. Directional lamps shall be equipped for simultaneous flashing for emergency use. They shall be controlled by a switch located on the Driver's side console, or from a momentary foot operated push button switch located on the floor on the left side of the steering column with the side turn buttons. The SRTA will approve the final configuration of the floor switch layout at the pre-production meeting.

14.18 Interior Lighting

- a. Front and rear stepwells shall be lighted by Dialight, or approved equal, LED suitably mounted so that entire stepwell and a portion of the ground area immediately outside the coach is illuminated.
- b. An overhead interior LED lighting system, Dinex, or approved equal, shall provide general illumination in the passenger compartment and shall be controlled independent of the run switch. The system shall provide a minimum of 15 foot-candles of illuminance on a one square foot plane at an angle of 45 degrees, centered 33 inches above the floor and 24 inches in front of the seat back at each seating position. The floor surface in the vestibule shall be illuminated at a minimum of 4 foot-candles with the front door open and a minimum of 2 foot-candles with the front door closed. Lighting intensity for all cross seats, forward of the rear longitudinal seats, shall have a minimum average of 15 foot candles, with a minimum of 12 foot candles at the seated passenger reading plane. An effective level of lighting shall also be provided for all other seated passengers. The

manufacturer shall supply a copy of its test results that indicate compliance with the specified lighting levels at the pre-production meeting.

- c. LED light fixtures shall be located above the side windows at or near the juncture of the coach ceiling and the side wall and may be provided over the rear door. The fixture lenses shall be clear polycarbonate and will effectively mask individual LEDs to make them invisible with no "hot spots." Lenses shall be sealed to inhibit incursion of dust and insects and still be easily removable for service. All fasteners used must be held captive in the lens assembly. Access panels shall be provided to allow servicing of components located behind the light panels. Interchangeability of lamps, lenses, fixtures, and power supplies shall be maximized.
- d. The light source shall be located to minimize windshield glare. High power LED strips shall be in one-foot sections, manufactured by Nichia or Philips, or approved equal, with expected life of the LEDs to maintain 60 to 70 percent of original brightness after 60,000 hours of operation. The brightness of each individual light fixture shall be programmable to minimize glare. Photo sensors shall detect and adjust lighting levels relative to ambient light for passenger comfort.
- e. Driver module shall have built-in self-protection of thermal shut-down and restart, and PWM (pulse width modulation) output to regulate light level.
- f. Failure of any light fixture or driver module shall be indicated via a telltale light panel or dashboard display.
- g. The lighting assembly will be compatible with the bus manufacturer's overhead AC/Climate Control air distribution system, which will also include provisions for advertising media located adjacent to the lighting, although the interior lighting requirements shall be attained without advertising media installed. The lighting system materials shall comply with the Federal Transit Administration Docket 90-A Specification.
- h. Interior advertisement racks shall be reinforced by use of structural members attached directly to the coach structure. The advertisement racks shall be hinged to provide access to the air plenum at every fixture location without removing the fixture from the coach structure. The card racks shall be retained in the closed position by use of threaded closing screws.
- i. Driver's light shall be Xantech Model 107276, or approved equal. Light to be recess-mounted in the top of the window frame above driver's head. Do not impair use by location conflict with sun visor. Location to be approved by the SRTA. Switch to be located on the bezel of the lamp.

15. **BODY**

15.1 Construction: Body and Understructure

- a. The basic body structure shall be an integral design. The structure shall be designed for maximum strength, reliability and durability. The bolted aluminum body structure combines the strength of cast and forged aluminum corner gussets with high strength extruded aluminum structural sections. These aluminum structural sections are secured together with specially designed bolt-

in-place gussets. The bolts are precision torqued and coated with a thread-locking compound.

- b. Body and understructure shall be adequately reinforced at all joints and points where stress concentration may occur so that the vehicle will carry the required loads and properly withstand road shocks.
- c. The entire coach understructure, including the wheelhouses, shall be spray coated with PPG Corashield 7972 taupe undercoating, or approved equal.
- d. All interior and exterior metal surfaces shall be cleaned and treated to prevent rust and/or corrosion. After welding in areas where primer was previously applied, all joints shall be brushed to eliminate foreign matter and then the joint shall be cleaned with a phosphorus solution to provide a good base for good paint adhesion. Finally, the joint shall be painted with red oxide primer.
- e. Aluminum panels shall be properly prepared and primed before final paint. All bolts, nuts, washers, clamps, clips, and similar parts, shall be zinc or cadmium plated or phosphate coated to prevent corrosion.
- f. All exterior body seams, joints and overlapping panels shall be sealed against entry of water or dust. Where dissimilar metals meet, proper care shall be taken to prevent electrolytic corrosion.
- g. All material used in the body and chassis, including cross members, posts and panels, shall be of the required strength for the purpose intended and shall be properly treated to resist corrosion. All joints exposed to weather shall be made tight against leakage.

15.2 Construction: Chassis

- a. Understructure shall consist of structural stainless steel for maximum durability, reduced maintenance, and weight and improved corrosion resistance. It shall be welded and Huck bolted throughout.
- b. Conventional bolt construction shall be with Grade 8 (traceable) hardware, and shall be used only where necessary to allow for routine disassembly (e.g., the closing crossmember shall be bolted to allow for engine removal at overhaul). No movement at bolted joints shall be allowed.
- c. Understructure at the coach sides in the lowered floor area shall have crash protection consisting of continuous minimum 3/16" steel plate at an angle which will tend to cause an impacting vehicle to subvert. The crash protective steel plate shall be an integral, welded part of the structure, continuous between the wheelwells except for the exit door. Effectiveness of the design shall be documented by successful application of crashworthiness test. Results of such testing shall be submitted prior to delivery of first coach, and must meet the standards set forth in Federal Register Volume 47, No. 195, Section 2.1.2.10.
- d. Understructure at the front and rear overhang (defined as the distance between axle centerline and bumpers) shall be sufficiently robust to permit towing or lifting without special rigging being required. The design shall be verified by submission of those part of the STRUAA (Altoona Test) which address towing/recovery.

- e. The understructure shall incorporate minimum 3/16" steel floor material in the area of the vestibule, the driver's platform and the exit door area. The installation shall be sufficiently rigid to prevent flexing, and to permit rigid mounting of a farebox.
- f. Understructure shall provide protected pathways for hydraulic lines, heater piping, airlines and electrical cabling. PVC tubing shall be used as protective conduit for wires and cables. Joints in lines, hoses, etc. shall be accessible for repairing.

15.3 Construction: Exterior Panels

- a. Body structure shall be modern, and aesthetically pleasing without protruding fasteners. Visible exterior fasteners shall be kept to an absolute minimum.
- b. Side panels below the window line shall be aluminum, etched, primed and painted to the SRTA paint scheme. These side panels shall each be replaceable by a mechanic without assistance. Welding, riveting, or adhesive attachment is deemed unacceptable, although adhesive, as a secondary method to control panel resonance will be permitted.
- c. All side panels shall be essentially flat, without ripples and with minimal visible joints.
- d. Side panels shall be simple enough in shape to allow fabrication with no more tooling than a shear brake and edge roller. Metal panels with compound curves, fluting, curved indentations, etc. will not be permitted.

15.4 Construction: Hardware

Fasteners must be of non-corroding material or finished to prevent rust and corrosion. Boron fasteners are not acceptable.

15.5 Insulation

- a. Interior of body, including roof, must be well insulated against heat, cold and noise.
- b. Roof insulation shall polystyrene EPS insulation.
- c. Sidewall insulation shall meet the same specifications as roof insulation. It shall be installed in all sidewalls, window post areas, and areas over the front and rear wheelhouses.
- d. The insulation referred to above, or other additional insulation, shall provide effective sound attenuation for the passenger.
- e. There shall be Barymat BYUF-14C 1" foam insulation, or approved equal, in the engine compartment to restrict, to the maximum practical extent, the entry of fumes, odors and heat into the passenger area.

15.6 Flooring: Plywood

- a. Floor shall be constructed of marine grade, seven (7) ply 3/4", Greenwood Alkaline Copper Quat (ACQ) hardwood plywood, or approved equal.
- b. The underside shall be primed with PPG Corashield 7972, or approved equal. The cut edges shall be sealed with either white lead, liquid neoprene, liquid urethane, Tuffcote, or Dolchem 606 or approved equal.
- c. Floor shall be laid in such a manner as to be free from squeaks. All edges shall be over underframe members.
- d. Floor shall be reasonably level throughout and all joints between the floor and vertical surfaces shall have a cove molding.
- e. Plywood shall be securely bolted to frame members. Self-tapping screws may be used.
- f. Underframe shall be stiff enough to prevent floor from excessive flexing under normal loads. The floor shall be supported so that when a person of 150 pounds or more steps on any area, there will be no discernible flexing or movement.
- g. The area at the farebox shall be of adequate strength to support the farebox safely and durably.
- h. The entire wooden floor shall be thoroughly sanded in preparation for application of floor covering material.

15.7 Roof

- a. Roof shall be an one piece fiber reinforced plastic (FRP) sheet constructed in accordance with the manufacturer's standard and of sufficient strength and stiffness to prevent vibration, drumming or flexing in service.
- b. A rear roof hatch shall be provided to meet the requirements of FMVSS 217.
- c. All seams, joints and overlapping panels, shall be thoroughly sealed to prevent the entry of water and dust. Where dissimilar metals meet, proper care shall be taken to prevent electrolytic corrosion.

15.8 Stepwells

The entrance and exit floor areas are to be sloped to prevent accumulation of water or ice.

15.9 Wheelhouse

Wheelhouses shall be of sturdy construction, manufactured of fiberglass, providing ample clearance at front and rear tires under load and under all positions of front wheel steering.

15.10 Fenders

Rubber fenders shall be furnished at each wheelhouse and shall be formed so as to effectively prevent road water/dirt from splashing up and onto driver's mirror and windows.

15.11 Splash Apron

Splash aprons, made of not less than one-quarter inch (1/4"), three-ply rubberized fabric, or one-quarter inch (1/4") cured masticated tire friction material, black color, shall be provided at the rear of the wheelhousings, projecting downward to a point approximately six inches (6") above ground with coach loaded. Aprons shall have a maximum width compatible with the understructure of the coach.

15.12 Drip Moldings

Water-deflecting roof gutters shall be provided over the side windows and doors.

15.13 Access Panels

- a. There shall be adequate access to the engine compartment and rear mounted air conditioning compressor. The manufacturer shall provide easily removable frame members, etc. so as to allow quick access of components.
- b. All panels shall provide adequate space to assure easy removal of components or sub-components.
- c. All access panels, except for the rear engine door, shall be secured by the use of five-sixteenths inch (5/16") square key locking devices.
- d. There shall be exterior access to the engine compartment at the rear, left, and right side of the coach.
- e. All service and access panels shall be hinged at the top with a continuous rubber or stainless steel hinge. Hinges shall not be painted.
- f. All exterior service doors shall be equipped with no less than two (2) heavy duty gas assisted struts for ease of opening and firm closure of doors.
- g. The fuel closure door shall be large enough to allow for easy hook-up of the Emco-Wheaton fuel nozzle, or approved equal. The minimum dimensions of the fuel door opening shall be ten inches (10") square.
- h. Any exterior accessible electrical compartments shall be sealed to protect its contents from inclement weather.
- i. The battery box door shall be secured with no less than two (2) exterior rubber locks to allow quick access to the batteries.
- j. The front access panel (if equipped) for lights, towing connector and towing eyes shall be hinged and secured with no less than two (2) five-sixteenths inch (5/16") square key lock devices. Wiper motors shall be accessible from removable panels located on the exterior of the coach.

- k. The radiator/surge tank fill, windshield solvent fill, and shop air/air start fill areas shall be accessed by use of small hinged closure doors. Doors shall be spring loaded with stainless steel hinges.
- l. There shall be interior access to the engine and air conditioning system. Such access shall consist of no less than three (3) removable panels in the following locations:
 - * Rear bulkhead panel at the air return (with 5/16" square key locks).
 - * Top of the rear settee (with captive fasteners).
 - * Lower front section of rear settee (with captive fasteners).

The entire front vertical settee panel shall be covered with #302 stainless steel, #4 finish bolted in place with proper hardware.

15.14 Bumpers

- a. Energy absorbing front and rear bumpers shall be furnished. Romeo Rim, "HELP" energy absorbing front and rear bumpers, or approved equal, shall be provided.
- b. Bumper material shall be black in color and corrosion resistant. These qualities shall be sustained throughout the service life of the coach.
- c. No part of the coach, including the bumper, shall be damaged as a result of a five (5) miles per hour impact of the coach at curb weight with a fixed, flat barrier perpendicular to the coach's longitudinal centerline.
- d. Bumpers shall protect the coach and a stationary four-thousand (4,000) pound, post 1983 American automobile from damage as a result of impacting at six and one-half (6.5) miles per hour into the rear bumper of the automobile parallel into the longitudinal centerline of the coach and at five and one-half (5.5) miles per hour into the rear bumper of the automobile at a thirty (30) degree angle to the longitudinal centerline of the coach. The energy absorption system of the bumper shall be independent of every power system of the coach and shall not require service or maintenance in normal operation during the service life of the coach. The flexible portion of the bumper may increase the overall coach length by no more than six inches (6").
- e. The rear bumper and its mounting shall provide impact protection to the coach at curb weight from a two (2) miles per hour impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the coach. The rear bumper shall protect the coach, when impacted by the striker defined in FMVSS No. 215 loaded to four thousand (4,000) pounds, at four (4) miles per hour parallel to, or up to a thirty (30) degree angle to the longitudinal centerline of the coach. The rear bumper or bumper extensions shall be shaped to preclude unauthorized riders standing on the bumper and shall wrap around the coach to protect the engine compartment doors and radiator.
- f. The bumper extensions shall not hinder service and shall be flared into the coach body with no protrusion or sharp edges. The bumper shall be independent of all power systems of the coach and shall not require service or maintenance in normal operation during the service life of the coach. Any flexible portion of the bumper may increase the overall length by no more than six inches (6").

15.15 Towing Eyes

Two (2) front towing eyes, concealed and located above the bumper, shall be provided. Two (2) rear towing eyes will be located beneath the rear bumper on the main chassis structure to allow the coach to be lifted by a towing vehicle without damage to the rear bumper, body panels, or structure.

16. **WINDOWS**

16.1 Windshield

The windshield shall incorporate a two-piece design constructed of one-quarter inch (1/4") thick safety plate laminated glass. Both right-hand and left-hand windshields shall be retained in the body structure with "zip-lock" black rubber extrusions for ease of maintenance. The operator's section of the windshield shall be sloped at sufficient angle to minimize windshield reflections and glare.

16.2 Windshield Wipers and Washers

- a. Windshield wipers and equipment shall be Sprague Electric, or approved equal, and shall provide an adjustable time delay feature. The coach shall be equipped with variable speed windshield wiper for each half of the windshield with separate controls for each side. No part of the windshield mechanism shall be damaged by manual manipulation of the arm. At 60 MPH, no more than 10 percent (10%) of the wiped area shall be lost due to windshield wiper lift. Both wipers shall park along the edges of the windshield glass. Windshield wiper motor mechanisms shall be easily accessible for repairs or service from inside or outside the coach and shall be removable as complete units.
- b. The windshield washer system shall deposit washing fluid on the windshield from nozzles attached to the wiper arms and shall evenly and completely wet the entire wiped area. The windshield washer system shall have a reservoir of at least two (2) gallons located for easy refilling. The reservoir itself shall be translucent for easy determination of fluid level. Reservoir, reservoir pumps, lines and fittings shall be corrosion resistant and protected from freezing.

16.3 Side Windows

- a. All passenger windows shall be manufactured by Ricon, or approved equal.
- b. Windows shall have black anodized aluminum frames. All windows shall be $\frac{3}{4}$ lower egress and all windows of the same size shall be interchangeable. All egress handles shall be located towards the front of the coach. Windows shall be designed to prevent the entrance of air and water when windows are closed. Near each window there shall be instructions on decals or aluminum plates that sufficiently explain emergency exit procedures. Location of the metal decal shall be determined by the SRTA.
- c. The lower section of the window, approximately thirty inches (30") shall be fixed. The upper portion of approximately nine inches (9") shall be inwardly openable to provide adequate outside air ventilation and shall have locking latches.
- d. Windows shall be one-quarter inch (1/4"). Glazing material: Tempered with Thermo Guard Dark Grey 20-24%. Glass Guard: Transit Care. Glazing Attachment: Bonded Serviceable. Glazing color shall be consistent from window to window with the exception

of the upper destination sign window. Upper destination sign's window shall be clear in color.

16.4 Driver's Window

Driver's window shall be a two (2) piece standard slider window with ¼" laminated safety glass. The window shall have a ratchet mechanism to prevent uncontrolled sliding. There shall be an interior and exterior "non-locking" handle on front vertical bar of the Operator's window. There shall also be a "non-locking" handle placed on the second interior vertical window frame. The rear window section shall be equipped with a locking mechanism which may be incorporated as part of a handle.

17. **PASSENGER DOORS**

17.1 Front Entrance Door

- a. The front door shall be of aluminum, two-section, slide-glide with minimum clear opening dimensions of 34 inches wide. The vertical and horizontal door clearances will comply with all A.D.A. requirements.
- b. Door shall be inward opening and shall have stainless steel hinges with joints at the door posts covered by rubber seals. Meeting edges of door shall have four inches (4"), extruded overlapping type rubber safety edges two inches (2") on each half.
- c. Door shall be fully air-operated with Vapor, or approved equal, door motor. An air shut-off valve, located either immediately above the front door within the header compartment, or at left of driver controls, shall be supplied. When valve is in "Off" position, front door shall be capable of being opened and closed manually.
- d. Each door section will be equipped with a handrail, powder coated yellow, that is designed to minimize the incursion into the clear door opening. The area between the front entrance and driver's station shall have a yellow powder coated handrail to aid in boarding the coach.
- e. Access door to door mechanism compartment 5/16" square key and shall have a chain or other acceptable device to hold door in the open position, when necessary.

17.2 Rear Exit Door

- a. Rear exit door shall be aluminum two-section outward opening manually opened by passengers via touch-bar controls and closed by spring-loaded check mechanism. Clear opening of door shall be a minimum of thirty-four inches (34") wide.
- b. The door operating mechanism, mounted on a removable steel base plate in a compartment directly above the door, shall be a Vapor Corporation, or approved equal.
- c. Meeting edges of the door shall have four-inch (4") extruded overlapping type rubber safety edges, two inches (2") on each half.
- d. Access door to door operating mechanism shall have a chain or other acceptable device to hold door in the open position, when necessary.
- e. Rear exit door shall be equipped with door ajar alarm.

17.3 Door Controls and Interlocks

- a. Both front and rear doors shall be controlled by a five (5) position door operating control, with the following positions:

- Front door open - rear door unlocked
- Front door open
- Both doors closed
- Rear door unlocked
- Rear door unlocked - front door open.

This control shall be located on the console to the left of the operator.

- b. A brake and accelerator interlock shall be provided that prevents movement of the coach when the rear doors are open. The interlock equipment shall be mounted together as one assembly.
- c. A rear door override lever shall be provided for emergency exit. The lever shall be located in the rear, door control, compartment. The lever is used to release the rear door from the locked position for manual operation and also shall engage the interlock.
- d. A master interlock override switch shall be provided. It shall be located in the electric panel near the driver and shall be in a secure position. Location to be approved by the SRТА.

17.4 Door Glass

Each section of the door shall be glazed with one-quarter-inch (1/4") nominal laminated glass.

18. EXTERIOR MIRRORS

18.1 General

Coaches shall be equipped with two (2) mirrors, one (1) mounted on the roadside front corner post and one (1) mounted on the curbside front corner post. Roadside mirror just above lower edge of driver's roadside window. Curbside mirror is not to extend further than a twelve inch (12") radius from the corner of coach and shall be mounted on the curbside front corner post.

18.2 Curbside and Roadside Mirrors

- a. Mirrors shall be a remote adjustable B&R Model 910/911R with all metal hardware, or approved equal. The controls shall be located to the roadside of the driver and provide for a full range of adjustment of the mirrors. The glass shall be easily replaceable and be secured with Velcro. The mirrors section shall be with 9-1/2" wide by 11-1/2" high mirror glass.
- b. The driver's side glass shall be flat. The curb side shall be split with a lower convex mirror of no less than 2-1/2" in height.
- c. All hardware utilized for the exterior mirrors shall be stainless steel.

- d. There shall be a weatherproof electrical quick disconnect, located between the coach body and the exterior of the mirror head for easy removal of the assembly.
- e. The mirror heads and arms shall be a heavy-duty retractable design to prevent damage from fixed objects and during bus washing through automatic washers. The mirror heads shall be connected to the arms with adjustable aluminum or brass ball type stems with metal set screws. No plastic parts shall be used on the mirror head adjustment. The mirror heads shall be spring loaded for additional protection. Mirrors shall be fully adjustable by the operator without the use of tools.
- f. Mirror shall not be less than six and one-half feet (6 1/2') above the pavement nor extend more than a twelve inch (12") radius from the corner of the coach. Final location of each side mirror shall be approved by the SRTA at the pre-manufacturing meeting.

19. **INTERIOR**

19.1 Floor Covering

- a. Floor shall utilize RCA Transit floor flooring material, color TR560 Cuban brown with rust and crème chips, or approved equal. Floor covering shall be butt joined. Should any gaps be unavoidable, they shall be filled with color matching material so as to be tight against any influx or seepage of water present in any uneven floor edges which might cause a person, walking on them, to trip. The floor shall be cleaned thoroughly before delivery.
- b. Steps at the front entrance and rear exit shall be covered with five-sixteenths inch (5/16") ribbed flooring, color Ultra-midnight TFM-27421. Entrance and exit step treads shall include integral molded yellow noses on stainless steel metal backing. Backing to be totally enclosed in rubber.
- c. Entrance area and front standee area shall be covered with ribbed flooring not less than five-sixteenth inch (5/16") in thickness. The entrance area and the standee area are to be separated by a yellow strip molded into the flooring. A six-inch (6") stainless steel backing shall be furnished under standee line edge.
- d. Center aisle and rear exit door approach area shall be covered with a ribbed floor covering not less than three-sixteenths inch (3/16") in thickness. Center aisle strip shall be twenty-two inches (22") wide.
- e. Floor area under the seats, including driver's area, shall be covered with a mottled smooth floor covering not less than one-eighth inch (1/8") in thickness. The material is to be thoroughly cemented into position throughout the entire area. The floor covering shall not be extended up on the wheelwell housing but shall terminate where the floor covering butts the housing. A stainless steel trim molding shall be installed on the flooring at the point the wheelwell housing and floor covering butt.

19.2 Modesty Panels

- a. All modesty panels shall be covered with matching Melamine paneling, color to be Nepal Teak, with paneling grain running horizontally.
- b. All modesty panels shall be attached to the stanchions and/or handrails with rivets or bolts with self-locking nuts.

- c. A modesty panel of approximately thirty-four inches (34") in height shall be installed within the handrail area of the rear side of the front stepwell. This panel shall have adequate clearance from the front door, to prevent injury to passenger's hand(s) during the opening cycle. The upper section of the front door modesty panel shall be constructed of 3/8" thick 14" Graylite (dark tint) Lexan.
- d. A modesty panel of approximately thirty-four inches (34") in height will be installed within the handrail area of the rear side of the rear stepwell.
- e. All modesty panels shall be raised three inches (3") above floor level.

19.3 Driver's Barrier

- a. A full height barrier beginning 6 inches above the floor shall be provided directly in back of the driver's station to separate the driver from the passenger compartment. The barrier shall extend from the left side coach wall to the stanchion at the right rear of the driver's station and then wrap around the side of the driver's seat. This panel shall in no way interfere with the safe normal operation of the coach or restrict movement of the driver's seat.
- b. The manufacturer will be responsible for the purchase and installation of a SRTA designed schedule rack on the rear facing side of the Driver's barrier.

19.4 Interior Trim

- a. Interior panels shall be applied to ensure a neat and finished appearance. Fasteners shall be of such type that they will not loosen because of vibration. Panels shall be supported so as to prevent buckles, drumming, or flexing when the vehicle is in service. All panel joints shall be sealed and covered with protective trim strips to guard against sharp edges. All interior ledges shall be angled so as to prevent any unwanted storage of materials.
- b. Ceiling trim panels shall be Melamine, Melamine bonded to aluminum one-tenth inch (1/10") minimum thickness. Color shall be complementary to the interior of coach. Color shall be Wilson Art Frosty White 1573-1.
- c. Sidewall trim/panels below the windows shall be Melamine, 1/10 inch minimum thickness. Color for the lower sidewall panels shall be Nepal Teak, with paneling grain running horizontally.
- d. Window mullions shall be Melamine, 1/10 inch minimum thickness applied in sections with trim strips covering panel joints. Color for the window mullions shall be Wilson Art Frosty White 1573-1 to match the ceiling panels.
- e. All interior surfaces forward of the standee line shall be nonreflective black or a color complementary to the interior of the coach.
- f. Panel behind rear settee shall conform to the requirements of Federal Safety Standard No. 302-Flammability of Interior Materials. The inside rear bulkhead panel shall be covered with Melamine, 1/10 inch minimum thickness, color to be Nepal Teak. Such a panel shall have an easily removable access door equipped with tamper proof captive fasteners for servicing of the air conditioning/heater unit.

- g. All trim moldings around wheelwells, sidewall, cove area, settee riser, front dash area, and panel below driver's window, shall be stainless steel.
- h. The colors noted above reflect the SRTA's current standard colors. A color final interior scheme shall be furnished for SRTA approval during the pre-production meeting.

19.5 Stanchions/Grab Rails

- a. All Proposers shall be responsible for supplying a stanchion/grabrail layout during the technical proposal process for review by the SRTA.
- b. All stanchions and grab rails shall be one and one-quarter inch (1-1/4") diameter smooth surface anodized extruded stainless steel tubing, with fittings that match tubing. Minimum tubing thickness shall be .065-inch.
- c. Fittings shall be stainless steel, heavy-cast aluminum, or cast zinc corrosion resistant material.
- d. A full length ceiling grab rail, shall be provided on each side of the coach. Such a grab rail shall be attached with baked enamel finished, wraparound clamps.
- e. Ceiling grab rail ends shall terminate at the ceiling connection. A vertical stanchion shall be mounted from the floor to the ceiling or ceiling grab rail at the right rear of the Operator's seat. A vertical stanchion shall be mounted from the floor to the ceiling or ceiling grab rail at the inside rear of the front stepwell and at the front and rear of the rear stepwell.
- f. A handrail shall extend from the front and rear stanchions to the body side, approximately thirty-four inches (34") above the floor.
- g. A handrail shall extend from the aisle side stanchion to the bottom stepwell riser. Such a handrail shall maintain a distance of approximately thirty-four inches (34") above the stepwell risers. This will be provided on each side of the rear stepwell.
- h. A vertical stanchion running from the seat bottom to the ceiling or ceiling grab rail shall be installed in the middle of all longitudinal passenger seats.
- i. Entrance grab rails shall be installed at the front stepwell area of the coach. Such a grab rail shall be affixed to the wheelchair lift platform. The grab rail shall not interfere with wheelchair maneuverability. They shall be stainless steel construction. In addition, grab rails shall be installed on each half of the front door which do not interfere with the lift grab rails.
- j. A grab rail shall be installed beginning at the Operator's right front dash corner, going around the farebox and terminating at the right side dash area. Such a grab rail shall be located approximately eighteen inches (18") from the dash and twenty-five and one-half inches (22.50") from the Operator's platform. Bracing shall be installed from the top of the grab rail to the top of the dash panel. Installation of such a grab rail shall not interfere with removal of the farebox, cash box, or with the maneuverability of a wheelchair passenger. Final layout of the entrance farebox rail shall be approved by the SRTA.
- k. All grab rails in the front entrance, including the doors, farebox rail, and vertical stanchions shall be powder coated in yellow for increase visibility. Rear door area stepwell and transition grabrails shall be powder coated in yellow for increased visibility.

19.6 Interior Panel/Door Securement

- a. The Operator compartment shall be equipped with no less than two (2) five-sixteenths inch (5/16") square key locking devices to be accessed by use of the door interlock control. This door will also be equipped with a gas prop or spring loaded hinge.
- b. All removable dash panels and service compartments shall be equipped with non-removable locking fasteners with a Phillips, straight edge or special designed head.
- c. All door motor access doors shall be equipped with no less than two (2) five-sixteenths inch (5/16") square key locking devices to be accessed by use of the door interlock control. All doors will be equipped with no less than two (2) spring loaded hinges.
- d. Air conditioning evaporator grille shall be equipped with no less than two (2) five-sixteenths inch (5/16") square key locking devices to be accessed by use of the door interlock control. The door shall be equipped with no less than two (2) spring loaded hinges.

19.7 Interior Mirrors

- a. Coaches shall be equipped with two (2) inside rear view mirrors. Center rear view mirror above windshield shall be four inches (4") by sixteen inches (16"), and right windshield header mirror shall be a six inch (6") round. The four inch (4") by sixteen inch (16") mirror shall be located so as not to interfere with passengers. All mirrors shall be mounted so that they will be vibration-free when engine is idling and when coach is moving.
- b. Coaches shall be equipped with twelve inch (12") round diminishing mirror to be mounted at the rear exit door in such a way so it will not interfere with passengers and may be viewed by the operator from the forward mirror.

19.8 Sun Visors

Padded visors or roller type shades shall be provided on driver's side; one shall be for the windshield and one shall be for the driver's side window. They shall be adjustable horizontally and vertically. Visor shall be constructed of heavy-duty material and assembled to last the life of the coach in normal operations.

19.9 Passenger Stop Request Signal System

- a. A passenger "Stop Request" chime system shall be installed.
- b. The system shall consist of a yellow plastic coated wire rope, running horizontal from directly behind the front modesty panels to the last rear window of both sides of the coach. The cable shall run horizontal between the bottom of the top "opening" window and the top of the bottom "fixed" window. Such a cable shall not sag below the horizontal window frame more a maximum of one inch (1"). Cable shall be affixed with eye loops at every window post. The pull cords shall not cause interference upon opening of windows.
- c. The cable shall also run vertical at the wheelchair securement area and shall comply with ADA requirements. Tape swtched may be substituted for pull cords in the wheelchair tie-down area.
- d. A "Stop Request" sign shall be affixed to the front of the coach and will illuminate upon activation of the "Stop Request." Such a sign shall have white lettering on a blue

background. The sign will remain illuminated until passengers exit the coach and the front door is cycled.

- e. The passenger signal shall chime only one (1) time to stop continuous use by passengers. System will reset automatically when the front doors are cycled open and closed. The sign shall be equipped with an on/off switch located on the Operator's console.

19.10 Miscellaneous Interior Equipment

- a. A storage space of no less than one and one-half (1-1/2) cubic feet shall be supplied in the Operator's area. Such an area shall be located within easy access of the Operator. The compartment door shall be secured by two (2) five-sixteenths (5/16") square key locking devices.
- b. A metal coat hook (stainless steel) shall be furnished and installed at SRTA-approved location. A leather buckle-type strap (or vinyl/Velcro) shall also be installed to prevent coats from swaying.
- c. Amerex Model 400T ABC five-pound (5 lb.) dry chemical fire extinguisher and KD #610-4645 safety triangle kit, or approved equal, shall be installed. Location of both the fire extinguisher and the kit to be approved by the SRTA.
- d. The Contractor shall install one (1) SRTA provided trash bag holder. Final locations shall be determined at the pre-manufacturing meeting.

19.11 Passenger Seats

- a. The passenger seats shall be American Seating Model Insite design, sculptured Transit Seats, or approved equal, and shall meet flammability requirements of FMVSS-302.
- b. The two passenger transverse seats shall be thirty-six inches (36") wide, twenty-eight and one-half inches (28-1/2") overall front to back and eighteen inches (18") in seat depth. Flip up seats shall be identical in size and configuration.
- c. There shall be no less than twenty-eight inches (28"), hip to knee room between each seat.
- d. Seat assemblies and components of identical seats shall be mechanically interchangeable.
- e. The Proposer shall provide a completed seating layout with their "Technical Proposal" for review by the SRTA. The layout shall include all seat dimensions, hip to knee space, wheelchair maneuvering dimensions, modesty panels, grab rails and stanchions.
- f. The Contractor shall provide a seating layout with the maximum forward facing seating.
- g. The seats over the rear wheelhousings shall be longitudinal seats facing inward, providing seating accommodations for one or more passengers in various multiple arrangements.
- h. The rearmost bench seat shall provide seating accommodations for four (4) or five (5) passengers.

- i. All forward facing wheelchair jump seats shall be constructed to have the same high back appearance as the fixed 2 passenger seats. Individual side facing jump seats in the tie down area may match the other longitudinal seats in configuration.
- j. The passenger seat shall be supported from the sidewall by a cantilevered bracket of adequate structural design to support the seat under all conditions. The supporting structure shall be constructed and mounted in such a manner that the work of the coach dusting and cleaning is reduced to a minimum. Special attention shall be given to elimination of dirt-catching pockets.
- k. The seat shall have a passenger assist hand grip which shall be upswept on the aisle end to provide a vertical hand hold for the standing passengers. The hand grip shall be constructed of a structure covered with a vandal-proof energy-absorbing material. The overall design of the hand grip shall be aesthetically pleasing and enhance the general appearance of the seat.
- l. Back pads shall be separate from the seat cushions and shall be individual passenger type contoured for occupant comfort and retention. The foam padding shall be CR Safeguard compound attached to a rigid inner panel and covered with vinyl and/or a combination of vinyl and fabric materials. Back pads shall be securely fastened, firmly supported and readily removable without the use of special tools.
- m. Seat cushions shall be individual passenger type contoured for occupant comfort and retention. The foam padding shall be CR Safeguard neoprene compound.
- n. The back panel shall be made of stainless steel.
- o. The rear cross seat shall be comprised of an upholstered back pad assembly and a seat cushion assembly which shall be removable if required for engine access. Seat cushion shall be supported by a tubular steel frame.
- p. Jump or fold-up type seats shall be furnished in lieu of standard transverse seats at first right-hand and left-hand normal transverse seat locations. Seat belt reel shall not protrude into aisle way. The flip up seats shall appear the same as the normal transverse seats when folded down.
- q. Seat cushions shall be upholstered in Camria (Holdsworth). The SRTA shall approve the upholstery configuration prior to manufacture of the seats.
- r. The seat backs, sides, and any armrests shall be coated with no less than four (4) mils thickness of Anti Graffiti coating. No coating shall be applied to the seat cushion materials.

19.12 Wheelchair Access/Tiedown Stations/Restraint System

- a. Bus will be designed to maximize accessibility by wheelchairs and other mobility devices. The front entrance shall allow for a clear turning radius of 36 inches (36") from the driver's station to the door side entrance modesty panel. The front wheelhouse shall provide a minimum clear opening of 36 inches (36") to allow mobility devices to maneuver from the entrance door back to the tie down area.
- b. Accommodations shall be provided for two (2) wheelchair passengers to be secured in a forward-facing position in the area immediately rear of the front wheelhouses. The length of this area shall be fifty-eight inches (58") or greater, and the width shall equal the length

of the transverse seats and the modesty panels. Modesty panels shall be adequately reinforced to withstand impact of wheelchairs.

- c. The exit signal shall be no higher than four feet (4') above the floor in this area. Maneuvering room inside the coach shall accommodate easy travel for a passenger in a wheelchair from the loading device through the coach to the designated parking area, and back out. No portion of the wheelchair or its occupant shall protrude into the normal aisle of the coach when parked in the designated parking space(s).
- d. All dimensions for wheelchair maneuvering, parking, foot clearances, and turning area shall comply with ADA regulations or exceed them if as stated in these specifications. The Proposer shall provide a plan including layout drawings for entry, maneuvering, parking, and exiting of wheelchair passengers, with their Technical Proposal submittal.
- e. The Contractor shall furnish and install wheelchair restraints for each tie down location in the coach which comply with ADA regulations, including the accommodation of "scooter" type vehicles. The restraint devices as a minimum shall include:
 - * Four (4) permanently affixed red retractable "Y" wheelchair securement belts at the front and rear of the tie down area.
 - * A black three point lap/shoulder belt for passenger securement. The belt length shall allow for large motorized mobility devices.

Contractor shall furnish wheelchair tie-down specifications of the equipment to be furnished for SRTA in their proposal.

19.13 Access Ramp

- a. An access ramp shall be provided at the entrance door. It shall be the Lift-U, or approved equal, flip out. The ramp shall have a useable width of thirty-one inches (31") and meet all A.D.A. requirements. The ramp is to be operated by the driver from the seated position. In case of malfunction, the ramp shall be manually stowable.
- b. Because the SRTA loads many mobility devices from stop locations that are not equipped with sidewalks and curbs, a ramp angle of 6 to 1 is strongly preferred and required if available on the buses offered. Proposers must state if their access ramp meets the 6 to 1 ramp angle, and provide documentation that illustrates their access ramp installation and ramp angles when deployed.
- c. All interlocks required to meet FMVSS, and ADA requirements will be provided with the wheelchair ramp.

19.14 Driver's Station

- a. The design of the driver's station shall have as its primary objective the provision of an environment for the driver that will aid him or her to operate the coach safely and efficiently for long periods of time with minimum fatigue. Human factors design principles shall be used in the layout and proportioning of the driver's station and its components with attention given to safety, "comfort and fatigue", body support; the size, shape and location of switches, levers, pedals and gauges; and all other factors that affect the design objective.

- b. The driver's station shall accommodate drivers who are of various heights and body proportions by the use of human factors design in locating and proportioning the devices in the station and by the use of adjustable components such as the driver's seat and the steering column. It is required that the station accommodate drivers within a height range of 57 to 76.5 inches.
- c. The Contractor shall, as a joint effort with the SRTA, determine the location of all equipment with respect to proper lighting, ease of operation, accessibility and passenger flow. Factors to be considered include, but are not limited to, the provision of mountings for and deterring the location of the farebox, radio speaker, radio control head and any other equipment supplied by the SRTA. Complete details of the driver's station design shall be presented at the design review and at the prototype review for approval by the SRTA.
- d. The Operator's seat shall be the Recaro Model ERGO METRO AM80 black fabric 3-point belt, or approved equal. The seat shall be covered with heavy-duty black vinyl fabric, perforated for ventilation. High density polyurethane foam shall be used for the seat cushions. Seat shall be equipped with 3-point seat belt. The seat shall be provided with double shock vibration damping, and a stepless seat rake and back recline. Air operated lumbar adjustments and an air slide release shall be mounted a panel accessible to the driver. The seat shall provide for adjustment of the ride height via a pneumatic suspension which includes a quick dump air release. A three (3) position limit/lockout lever shall be provided to allow operators to set the seat in a fixed suspension height. Seat mounting shall allow for maximum fore and aft travel to suit a variety of drivers. The slides shall provide a minimum of 9 inches of usable fore and aft travel without contacting any part of the operator compartment area.

19.15 Public Address System

Contractor shall install a public address (P.A.) system as indicated below:

VLU Specifications

The VLU (Vehicle Logic Unit) shall be an open-standards based PC controller installed on the bus. The VLU shall employ a vast array of connections and interfaces to all on-board systems via standard PC and Transit system communication standards. This shall allow for growth for future onboard ITS systems and many years of service.

The VLU system shall provide integration to bus systems via proven transit and PC communication standards with SAE J1708/J1939/J1587, SAE J1939/CAN, RS232, and RS485 with busy line, TTL, USB, Ethernet, TCP/IP, discrete inputs and outputs, odometer, spare I/O, audio inputs and outputs, and full IDE capability for PC-type devices. The VLU shall use RS232, J1939 and J1708 to transmit information to the in-vehicle electronic display signs. The VLU shall be capable of integrating with camera systems to support security setups such as CCTV. VLU system shall be capable of handling GPS data in all areas. The VLU shall employ advanced location algorithms that utilize the GPS, gyroscopic heading, and odometer pulse to accurately report where the bus is along the route. The VLU shall employ these advanced location algorithms to ensure precise ADA compliant announcements as well as ridership data collection.

The VLU system functionalities shall include but not be limited to AVA (Automatic Vehicle Annuciation), WLAN (Wireless Local Area Network), Vehicle Health Monitoring, Predictive Arrival, APC (Automatic Passenger Counter) and CAD/AVL (Computer Aided Dispatch/Automatic Vehicle Location). The VLU shall employ integration that enables the necessary subsystems access to transmission of data through a single secure wireless LAN, which shall have the

capability to integrate with a real time communications network. In the event of an emergency causing a vehicle to lose communication links to the network VLU shall allow all on-board data to be retained locally on the bus.

The VLU shall be designed with forward looking, state-of-the-art technology and modularity. The VLU shall be designed to support easy installation and replacement. This design shall allow the VLU to withstand the harsh elements of the public transportation environment. A strong body casing shall protect against falling dirt, rain, sleet, snow, wind blow dust, vibration, pressurized hose-directed water, corrosion, extreme temperature variations, and external formation of ice. The VLU shall have a secure lock on the access door requiring a unique key to help protect the VLU from theft. The VLU systems minimum functions, power management, environmental, and capability requirements are summarized below:

Function and Design

- Single point logon
- 15 Year design life
- Real time voice & data communications
- Smart bus technology
- Replaceable and upgradeable solid state storage
- Support for full color LCD touch mobile data terminal
- Navigation with GPS, odometer, gyroscope, and map matching
- X86 and Windows XP compatibility
- Non-volatile data storage and collection
- Secure Wireless (WPA2) uploading/downloading employing WLAN security, updates, and uploads
- Network routing and dynamic IP addressing
- SAE J1939 (CAN) and J1708 interfaces
- Radio interface with handset, EA and covert microphone
- I/O & multiplex system Interface
- PA system with a minimum of 3x 30 watt amps and driver speaker amp
- Automatic volume control for at least 4 zones
- LED display for maintenance and diagnostics
- Power supply conditioning and management
- Compliance with SAE J1455 for environmental conditions
- Commercial, off-the-shelf component expansion

Power Management

- 35 Watts Nominal Power Draw
- 1.5 Amp @ 24Vdc Current Draw 18 Vdc to 48 Vdc Input Voltage
- Overvoltage Protection
- Reverse Protection
- Short Circuit Protection
- Dedicated Power Management Micro
- Protected from Ignition Interruption
- Programmable Delayed Shutdown
- Low Voltage Detect & Auto Shutdown
- Hardware/Software Watchdog
- Application Watchdog

Passenger Information

The AVA (Automatic Vehicle Annunciation) system shall provide override capability for the operator to announce and display “ad-hoc” or pre-recorded special announcement messages, including Public Service messages, to be announced and displayed through this annunciation system.

Initial audio files are to be provided by the contractor as digitally recorded announcements, generally using local voice talent to replicate local and regional pronunciations and accents. It is preferred the audio be developed using professional voice talent.

Updated and new messages shall be automatically downloaded to the fleet on-board system via wireless LAN when the busses are stopped at the maintenance facility at overlay or when the on-board system is powered up provided it is in range of the WLAN system. Updating of the on-board VLU data shall be possible via real time communications network.

The contractor shall provide its own voice annunciation system via the VLU, and an interior dynamic message sign. The proposed Automatic Voice Annunciation System meets the requirements of the ADA. The contractor shall provide a multi-lingual AVA system. The AVA system shall provide audible and visual annunciation for every stop, route, and route variation in the system.

The AVA System shall include at a minimum:

- Multi-lingual capability: Supports audio and text multi-language announcements
- Open Interface using J1708 VAN
- Automatic and operator defined annunciation control: Enables announcements based on trigger controlled parameters. Operator/manual over ride provisions for repeat, suspended, public safety announcements etc.
- Route- and location-based annunciation: Off-route, end of route and special service and route changes are detected and annunciations adjusted
- Visual Display: Supports a variety of sign types with coordinated text messages
- Automatic Volume Control: Automatic noise volume adjustments based on ambient noise
- AVL-based announcements: Location determination with precise accuracy to ensure proper announcements
- Destination Sign Control: Support of multiple vendors’ destination signs including Twin Vision, Luminator, Balios, Sunrise, or approved equal.
- Automatic annunciation updates: Secure wireless bulk data transfer system via 802.11 WLAN system to be installed at garages for automatic file download to the fleet

Interior Next Stop Announcement

The interior “Next Stop” announcement shall be configurable, the proposed Data Management system to operate in either “Departing Audio” or “Approaching Audio” mode. In Departing Audio operation, the “Next Stop” announcements are made as the bus departs the present stop en-route to the next stop. The distance the announcement is made from the present bus stop shall be a parameter of the VLU system and shall be configurable on the bus and through the server side.

In Approaching Audio operation, the “Next Stop” announcements shall be made as the bus approaches the next stop. The distance that the announcements are made from shall be a parameter of the VLU system and shall be configurable on the bus and through the server side.

The VLU System shall announce information regarding transfers to be made at the next stop after the phrase "Next Stop." This shall be configurable at the time for design finalization, as well as changeable through the provided server.

Interior Public Service Automatic or Operator-Initiated Announcement

Public Service audio messages shall be triggered automatically by a random algorithm defined within the server or manually by the Operator by selecting from canned, pre-recorded public service announcements.

All the public service announcements shall be stored on the on-board VLU System with the other operational data for the entire service area. The Operator shall be able to select and play a public service announcement from a list displayed on the Operator Interface.

Each message shall be represented by an easy to understand, text description of the announcement. The public service announcement shall be played over the PA speakers in the same voice as the pre-recorded ADA compliant AVA announcements.

The AVA system shall provide the capability for Automatic or Scheduled public service messages without Operator Intervention. Agency personnel shall be able to configure the system to automatically play public service announcements throughout the day with no operator intervention. These announcements shall play at intervals throughout the day.

Exterior Route and Destination

The VLU System shall integrate with destination signs to automatically display the exterior Destination messages after operator logon.

Announcement Priority

The VLU System shall control the priority of the announcements over the speakers. The prioritization system variable shall be managed through the server system and locally via the Operator through the Operator Interface. This feature shall control the priority of which of the two announcements, (live Operator announcement or the automatic announcement) gets played over the PA system speakers, in the event that they occur at the same time. The agency shall have the ability to change the priority using the server system.

Inside Signage

The VLU System shall control and provide stop description information to the LED signs automatically based on location based algorithms. The system shall also provide the date, time, and Stop Requested information.

Automatic Volume Control

AVC (Automatic Volume Control) shall be provided as part of the AVA solution. AVA shall monitor the ambient noise of the vehicle and raise and lower the volume of the automated announcements so that it is comfortably audible over the existing noise. The announcement volume shall be automatically compensated within a pre-defined acceptable range.

The system shall be capable of detecting ambient noise and performing AVC functions with microphones on the inside and speakers or microphones for outside detecting. The AVC system shall control and adjust the interior and exterior volume levels independent of one another. The interior and exterior volumes shall have an adjustable minimum and maximum volume. The AVC system shall adjust the volume within those set ranges. The AVC sensitivity shall also be adjustable. The server system shall manage these adjustments and all other AVA system

parameters. Maintenance personnel shall also have access to volume adjustments on the vehicle via the Operator Interface.

The AVC feature shall control volume levels by time of day. The agency will have the ability to select an interval of the day to further reduce the maximum volume levels attained. This "Commuter Volume" feature shall go into effect on the bus automatically without Operator intervention. The "Commuter Volume" levels are managed via the server system. The commuter time intervals shall not be fixed, but rather will be a variable of the system. This will enable the agency to reduce volume levels during the more quiet periods of the operation. The "Commuter Volume" levels will control the volume of both the exterior and interior announcements.

Automatic Passenger Counter Installation/Integration

The Automatic Passenger Counter controller shall be integrated with the on-board Mobile Data Computer, based on the standard SAE J-1708/J-1587 or J-1939 VAN. Automatic Passenger Counter sensors shall be mounted so as to avoid any protrusions into the doorway passage, with sealed windows for the infrared beams.

Cabling to the doorway sensors shall be shielded and routed to avoid sources of electromagnetic interference, such as fluorescent lighting ballasts. The doorway sensors and Automatic Passenger Counter controller shall be mounted in locations that are not accessible to the vehicle operator. The alignment of the doorway sensors shall be calibrated after installation to establish the alignment settings for each vehicle that achieve the most accurate performance.

Data Communication

The Mobile Data Computer shall use the wireless data communications to send and receive messages with the central software at any time. The data protocol used for transmission shall accommodate the required functionality for up to at least 300 vehicles at a 30 seconds polling interval. The system shall store data if communications are interrupted and forward data to the central system once communications are restored.

It shall be a rugged, all-in-one 3G/4G mobile communications solution with true enterprise class routing, security and firewall. It shall be ruggedized with integrated Wi-Fi access point, and minimum 4 port Ethernet switch.

Voice Communication

The radio shall be a Motorola CDM1250, or approved equal, with the remote mount option and include an operator Handset that integrates the radio to the VLU system.

20. DESTINATION SIGNS - FRONT, SIDE AND REAR

20.1 General

An automatic solid state electronic destination sign system, Twin Vision LED, or approved equal, shall be furnished and installed in the coach by the manufacturer. The destination sign system shall consist of:

- * Front Destination Sign, 16 rows by 160 columns; display height minimum 7.7 inches, display width 63"
- * Side Destination Sign, 14 rows by 108 columns; display height minimum 4.2 inches, display width 42"

- * Rear Destination Sign, 16 rows by 48 columns; display height minimum 6.1 inches, display width 18"
- * Operator's Control Unit and Readout Display
- * All Cables and Accessories
- * PCMCIA's and Programming Software

20.2 Destination Sign Type

- a. The System shall be microprocessor-based utilizing approved bi-directional serial communications, such as; S.A.E. J1708 or IBIS, E.I.A. RS-485, between System components, and shall utilize error detection techniques within the communication protocol.
- b. Independent Controller Boards shall be mounted in the front and side destination sign. The System shall be capable of communicating with, and/or controlling additional information devices, such as interior information signs, Voice Annunciation devices, farebox, etc. The System shall provide for destination and/or Public Relations (P/R) message entry.
- c. Flash memory integrated circuits shall be capable of storing and displaying up to 10,000 message lines. Message memory shall be changeable by the use of a PCMCIA Card of not less than one (1) megabyte memory capacity but sized according to the message listing noted herein.
- d. The System shall have the ability to sequentially display multi-line destination messages, with the route number portion remaining in a constant "on" mode at all times, if so programmed. It shall also be capable of accepting manual entry of Route Alpha/Numeric information on any/all signs.
- e. The System shall allow two (2) destination messages and one (1) public relations message to be pre-selected. The operator shall be able to quickly change between the pre-selected messages without re-entering the message code. Public relations messages, when selected, shall be capable of being displayed alternately with the regular route message or separately.
- f. The System message programming software shall provide a means of adjusting the length of time the messages are displayed from one-tenth (1/10) second to twenty-five (25) seconds duration. The blanking time between messages shall also be adjustable. Each line of text or the blanking time of each individual message shall be capable of having a different retention time.
- g. The System shall be of plug-in modular design, to facilitate maintenance and to allow destination display board changes and additions without removing any signs from the coach. The front and side sign system shall incorporate drive circuits and connectors for plug-in of the rear sign. The entire display area of all signs shall be clearly visible in direct sunlight or at night.
- h. An emergency message shall be activated by a push button or toggle switch in a location to be approved by the SRTA. The emergency message shall be displayed on the front sign only while signs inside the vehicle, including the OCU display, remain unchanged. The emergency message shall be canceled by entering a new destination code, or power cycling (after removal of the emergency signal).

- i. Power to the Sign System shall be controlled by the Master Coach run switch. The signs shall operate in all positions of this switch except the "off" position. The signs shall be internally protected against voltage transients and RF interference.
- j. All electronic circuit boards used in the Sign System shall be conformal coated to meet the requirements of military specification MIL-I-46058C. All Sign System components shall be certified to have been subjected to a "burn-in" test of a minimum of twelve (12) hours operation in a temperature of 150° F prior to final inspection.

20.3 Display and Display Illumination

- a. All sign displays shall consist of pixels utilizing high intensity Light Emitting Diode's (LED), for superior outdoor environmental performance, (of amber illumination appearance of light wavelength of 590 NM). LED should be made of AlInGaP II, superior UV resistant epoxy lens and superior resistance to the effects of moisture. Each pixel shall have a dedicated LED for illumination of the pixel in all lighting conditions. The Sign System shall have multi-level intensity changes, which adjust automatically as a function of ambient lighting conditions. There shall be no requirement for any fan or any specialized cooling or air circulation.
- b. This LED shall be mounted such as to be visible directly to the observer positioned in the viewing cone, allowing for full readability 65 degrees either side of the destination sign centerline. The LEDs shall be the only means of illumination of the Sign System. The LED illumination source shall have an operating life M.T.B.F. of not less than 100,000 hours. Each LED shall not consume more than 0.02 watts.
- c. The LED characters formed by the System shall meet the requirements of the Americans with Disabilities Act (ADA) of 1990 Reference 49 CFR Section 38.39.

20.4 Front Destination Sign

- a. The front sign shall be mounted on the front of the coach, near the top edge of the body, behind windshield protection, and in an enclosed but accessible compartment provided by the coach manufacturer. The compartment access door shall be secured by 3, 5/16" square locks. The compartment opening shall also be large enough to allow easy removal and installation a complete front sign assembly.
- b. The front destination sign message shall be readable by a person with 20/20 vision from a distance of 350 feet for signs of display height greater than 8 inches and from and distance not less than 275 feet for display heights less than 8 inches. The front sign shall have a viewing cone of equal readability at 65 degrees on either side of a line perpendicular to the center of the mean plane of the display. The intensity of the illumination of the display pixels shall appear to the naked eye to be approximately uniform throughout the full viewing cone.
- c. The sign mechanism shall be hinged on brackets to permit cleaning of the front inside side glass without the use of tools. The compartment shall be sealed to prevent entry of dust, dirt, water, and insects during normal operation and cyclone cleaning.
- d. The front sign compartment shall be enclosed by a UV protected clear glazing.

20.5 Side Destination Sign

- a. The side destination sign shall be located on the curbside, towards the upper portion of the passenger window that is located next to the front door. The side sign shall be mounted in a fixed position using brackets provided by the destination sign manufacturer.

- b. The side destination message shall be readable by a person with 20/20 vision from a distance of 110 feet. The sign shall have viewing cone of equal readability at 65 degrees on either side of a line perpendicular to the center of the mean plane of the display. The side sign shall be easily readable from the sidewalk level. The intensity of the illumination of the display pixels shall appear to the naked eye to be approximately uniform throughout the full viewing cone.

20.6 Rear Destination Sign

- a. The rear sign shall be located such that it will provide clear visibility of the sign from the rear curbside of the coach. The final location of the sign must be approved by the SRTA.
- b. The rear sign shall be capable of independently displaying alpha-numeric characters. Its message shall be readable by a person with 20/20 vision, from a distance of not less than 225 feet. The rear sign shall have a viewing cone of equal readability at 65 degrees on either side of a line perpendicular to the center of the mean plane of the display. The intensity of the illumination of the display pixels shall appear, to the naked eye, to be approximately uniform throughout the full viewing cone.
- c. The sign shall be completely sealed to prevent the entry of dust, dirt, or water from normal operation, automatic bus washers, and steam cleaning. The sign installation shall not interfere with driver's vision or reduce access for other component repairs.

20.7 Operator's Control Unit (OCU)

- a. The OCU shall be used to view and update display messages. It shall be recess mounted on the coach vehicle front sign compartment access cover or door. The OCU shall utilize a multi-key conductive rubber pad keyboard and be designed for transit operating conditions.
- b. The OCU shall contain a display of at least two lines of 20-character capability. The OCU shall emit a beep to indicate that a key is depressed. The OCU shall continuously display the message associated with the selected destination readings (except the emergency message feature as noted above).
- c. The OCU shall also contain the capability to manually select the block number sign information (from 1 to 4 alpha-numeric characters) to be sent to the block number sign, independent of any pre-programmed destination sign message information.
- d. If the IBIS interface is required in the Destination Sign System, an auxiliary RS232 (DB9) port shall be made optionally available on the OCU underframe for inputs from any wireless technology that might be envisioned in the future. This auxiliary RS232 port shall operate at 9600 baud and accept commands from a wireless source (such as Spread Spectrum receivers) and will set destination sign addresses as if manually operated by the OCU operator.
- e. If the J1708 interface is selected for the Destination Sign System, an auxiliary J1708 port shall be made available on the J1708 OCU so that auxiliary J1708 commands may be provided to the Destination Sign System from a wireless source that conforms to the J1708 command structure. TwinVision does not provide wireless apparatus, but the TwinVision Destination Sign System, or approved equal, has the capability of interfacing via the J1708 link with any such inputs, providing that the apparatus conform with the appropriate signaling specifications.

20.8 Transferring Messages and Updates

- a. The Sign System shall be reprogrammable on the coach vehicle with the use of a PCMCIA Card. A PCMCIA Card slot shall be provided on the OCU face for this purpose. The maximum reprogramming time for a 10,000 line listing shall be one minute. PCMCIA Cards, of appropriate memory capacity based on requirements of the message listing noted below (but not less than 0.5 Megabyte) shall be supplied at the rate of one card for each 50 systems, or fraction thereof, but in any event not less than two such PCMCIA Cards shall be supplied.
- b. A total of six PCMIA units shall be supplied at the time the first coach is delivered to the SRTA. All buses shall be programmed with the SRTA's most current run-book at the time of delivery.
- c. Adequate memory shall be provided with each sign system to hold the SRTA's current sign program, with a minimum reserve capacity of fifty percent (50%) for program expansion.

20.9 Programming Software

- a. A programming software package shall be provided to generate message lists for the destination sign system. The software package shall operate on an Intel based personal computer in the Windows operating system. The software package shall allow the PCMIA or flash card to be programmed directly from the PC. The program shall be designed to easily delete or add messages to an existing destination listing.
- b. The software shall provide capabilities for custom message writing by selection of preprogrammed standard and/or variable fonts; by creation of custom fonts; by varying spacing between message elements; by allowing creation of graphic displays or selecting preprogrammed images; and by allowing use of multiple fonts and graphic symbols placed anywhere within the display area.
- c. Complete documentation and instructions for use shall be supplied with the software package.

20.10 Electronic Interference

Electronic sign system shall not interfere with radio communications system, public address system, or any other electronic equipment installed on the coach by the coach manufacturer, or the SRTA.

20.11 Destination Sign System Readings

The SRTA shall provide the Contractor with a complete, up-to-date, list of Destination Sign codes to allow the signs to be preprogrammed with the correct readings.

20.12 Interior Headsign

An all LED interior headsign compatible with an Automated Visual Annunciator System shall be provided with cabling routed to the radio box for use with the SRTA's Clever Devices ACS radio system. It shall be mounted on the rear of the Driver's barrier facing rear towards the passengers.

21. VIDEO SURVEILLANCE SYSTEM

A video surveillance system, Penta Digital Video Recording System, or approved equal, shall be provided and installed in each bus.

21.1 Basic System

- a. Power Requirement: The DVR shall operate from 18 to 36 VDC. It shall be self-regulating and internally protected from power surges and spikes.
- b. Physical Attributes of DVR: The DVR shall have a maximum 11.5" x 11.25" x 3" outer housing and weigh no more than 14 lbs.
- c. External DVR Material Construction: The DVR shall be constructed with a ruggedized outer housing that offers shock and vibration protection.
- d. External Camera Housing Material Construction: The external camera housing for the DVR system shall be constructed out of ¼" cast aluminum.
- e. Video Inputs: The DVR shall record NTSC/RS170, 1 volt peak to peak video, from up to 8 sources.
- f. Inputs: The DVR inputs shall be NTSC/RS170 video format. The image capture rate of the system shall be user-selectable up to a maximum 8 frames per second. Playback shall not reduce the quality or resolution of the recorded scenes.
- g. Color or Black & White: The DVR shall record images in black & white, color, or both depending upon the camera source.
- h. Audio Input: The DVR shall record and playback a single channel of audio simultaneously with the recorded video.
- i. Compression: The DVR shall utilize wavelet hardware image compression.
- j. External Ports: The DVR shall be supplied with auxiliary ports for custom programming. These shall be a keypad port and a 10base T Ethernet port.
- k. Removable Drive: The DVR shall be a self-contained removable hard disk unit for storing digitized images and audio information. This configuration shall allow for easy removal of images for playback and archiving. The removable drive shall be portable and interchangeable.
- l. Dust Resistant Unit: The DVR shall filter dust from entry into the unit.
- m. Shock Resistant Mounting (all parts): The DVR shall be designed for heavy-duty automotive use, as well as be enclosed in a tamper-proof housing. The unit shall function within the normal operating characteristics of a coach or transit vehicle and shall be capable of withstanding a shock of 20 G's operational.
- n. Clock: The DVR shall have an on-board, real-time clock that operates independently of the main power supply. It shall be programmable to automatically adjust for daylight savings time.

- o. Lock: The DVR shall employ a key locking mechanism to secure unit contents and provide security to the removable unit.

21.2 LCD Keypad

- a. On-line: The LCD keypad shall display the system's on-line status.
- b. Date: The LCD keypad shall display the correct date in relation to the DVR's internal clock.
- c. Time: The LCD keypad shall display the correct time in relation to the DVR's internal clock.
- d. Frames Per Second (fps): The LCD keypad shall display the fps recording rate.
- e. Temperature: The LCD keypad shall display the system temperature while in the programming mode.
- f. Vehicle ID Number: The LCD keypad shall enable the user to program the vehicle ID number.
- g. Central Station Number: The LCD keypad shall enable the user to program the Central Station IP address and telephone number.
- h. Modem Password: The LCD keypad shall enable the user to program the modem password.
- i. Camera Name: The LCD keypad shall enable the user to program the camera name(s).
- j. Resolution Setting: The LCD keypad shall enable the user to program the camera resolution setting.
- k. Trigger Capture Rate: The LCD keypad shall enable the user to program the trigger capture rate.
- l. Trigger Resolution Setting: The LCD keypad shall enable the user to program the trigger resolution setting.
- m. Six Programmable Inputs: The LCD keypad shall enable the user to program up to six inputs.
- n. ID Name for Input: The LCD keypad shall enable the user to program the ID name for each input.
- o. Selectable Frame Per Second (fps) Capture Rate: The LCD keypad shall enable the user to increase the fps capture rate from .25 to 8.
- p. DVR Shut Down Delay: The LCD keypad shall enable the user to program the DVR shut down delay from 0 to 50 minutes.
- q. Audio Enable/Disable: The LCD keypad shall enable the user to enable or disable the audio feature.

- r. Surveillance Storage Time: The LCD keypad shall enable the user to program the desired surveillance storage time from 0 to 9 days.
- s. Alarm Storage Time: The LCD keypad shall enable the user to program the desired alarm storage time from 0 to 90 days.
- t. Transmission Feature Enable/Disable: The LCD keypad shall enable the user to enable or disable the transmission feature.

21.3 System Functionality

- a. Digital Video Recorder (DVR): The DVR can digitize, capture and record high-quality images. The images are then stored on the portable removable unit for review and playback at the Central Station. The DVR shall have, at a minimum, the following features and capabilities.
- b. Image Capture: The DVR shall store digitized video images.
- c. Image Capture Rate: The DVR shall capture images at a maximum of twelve frames per second.
- d. Time: The DVR shall record the actual time while recording images. This information shall be tied to images during playback at the Central Station.
- e. Date: The DVR shall record the actual date while recording images. This information shall be tied to images during playback at the Central Station.
- f. Vehicle ID: The DVR shall record the programmable vehicle identification number while recording images. This information shall be tied to images during playback at the Central Station.
- g. Camera Source: The DVR shall record the programmable camera name while recording video. This information shall be tied to images during playback at the Central Station.
- h. File Format of Recorded Images: The recording software should store the images captured via the DVR in a proprietary file format that can only be viewed by Kalatel's software. It is not reasonably possible to view the images using any other viewing software. In addition, it is not readily practicable to alter the pixels with common graphics tools or programs while they remain in the proprietary file format.
- i. Recording Audio: The DVR shall have the ability to record single channel audio by adding a microphone.
- j. Initialization of Recording: The DVR shall be signaled to begin recording at the start-up of the engine run switch of the vehicle.
- k. End Recording: The system shall remain fully functional for a programmable period of time up to fifty minutes after the ignition has been turned off. This process shall be initiated by deactivating the engine run switch.
- l. Continuous Recording: The DVR shall be capable of continuous image recording at a user-defined recording rate.

- m. Loop Recording: The DVR shall record continuously onto the removable hard drive. The system recognizes when the available storage capacity for surveillance images has reached capacity and automatically begins to purge the oldest data in sequential fashion, making room for additional images without operator intervention. Images that are tagged due to the activation of the system's inputs are protected from automatic overwriting until the relevant images are manually deleted, or until all available space is filled with tagged images, at which time the system performs a "first-in, first-out" (FIFO) overwrite.
- n. Event Tagging: The DVR shall tag events when a system input, such as a panic button, is activated. Tagged events are stored on the hard drive. When retrieved, the tagged events shall be easily identifiable and will remain saved for a programmable period of time before being overwritten.

21.4 System Options

- a. Synchronized Audio and Image Playback: The Central Station software shall have the ability to playback image databases with single channel audio if this option has been previously configured on the DVR.
- b. Cellular Transmission System: The DVR shall be upgradeable to a video transmission system (DVRT). The transmission system shall utilize analog cellular technology. The Central Station shall support multiple simultaneous incoming video transmissions. The Central Station shall also have the ability to call out to the vehicle and request images at multiple resolution settings.

21.5 Central Station

- a. The DVR system shall include, at a minimum, one Central Station. The Central Station shall be a personal computer (PC) operating under Windows®X. The Central Station Browser software can search and recall previously recorded video from the DVR's removable drive and shall include playback features (such as "animate") and selectable speed utilizing a slide speed bar. The Central Station software can also output the recorded images to other devices. The Central Station shall meet the following specifications, capabilities and features.
 - Central Processing Unit (CPU): The Central Station shall be a minimum dual core Intel processor based PC with 2 gigabytes of RAM. The display card shall be sufficient to operate the 21 inch LCD display in its native resolution.
 - Random Access Memory (RAM): The Central Station shall include a minimum of 2 GB of RAM.
 - Internal Hard Drive: The Central Station shall include a minimum of 250GB hard drive.
 - Monitor: The Central Station shall include a wide screen 21" LCD color WSXGA, or approved equal, monitor with a native resolution of 1600x1200, with a minimum contrast ratio of 1000:1 and a minimum refresh rate of 8ms.
 - Keyboard: The Central Station shall include a full-size PC keyboard.

- Mouse: The Central Station shall include a mouse.
- Operating System: The Central Station shall operate under a Windows® XP Media Center Edition operating system.
- Docking Station: The Central Station shall include an external docking station that is compatible with the DVR's removable unit.
- Ports and Expansion Slots: The Docking Station shall include a 10base T Ethernet port.
- Digital Output: Once files are downloaded standard software tools may be used to export video data to digital recording devices such as tapes or any high capacity storage medium.
- Windows® Compatible Printing Device: The Central Station can output still frames of previously recorded video sequences to a Windows® compatible printer with suitable graphics capabilities.

21.6 Central Station Software

- a. Central Station Software: The software shall allow the user to search, review, enhance, and print previously recorded images by hotkeys, mouse clicks and menu selections. The following describes the Central Station features.
- b. Search Capability of the Central Station: The Central Station software shall allow the operator to search previously recorded images from a DVR's removable hard drive. The operator shall use search criteria such as date and time. The following describes the search capabilities of the Central Station software.
- c. Date: The Central Station software shall have the ability to search and retrieve image databases based on a specific date.
- d. Time: The Central Station software shall have the ability to search and retrieve image databases based on a specific time.
- e. Alarm Event: The Central Station software shall have the ability to search and retrieve image databases based on a specific alarm event. This event is tagged and appears in a special window of the software.
- f. Central Station Reviewing Features: The Central Station software shall have the ability to review and playback image databases. The following describes these features.
- g. Animate: The Central Station software shall have the ability to playback or "animate" previously recorded image databases at user-selectable speed using the slide speed bar.
- h. Step Forward: The Central Station software shall have the ability to step forward in increments of one frame at user-activated intervals during playback.
- i. Step Back: The Central Station software shall have the ability to step back in decrements of one frame at user-activated intervals during playback.

- j. Go to End: The Central Station software shall have the ability to go to the end of the selected image database.
- k. Maximize Image: The Central Station software shall have the ability to maximize the size of the selected image to the largest image widow.
- l. Pause: The Central Station software shall have the ability to pause or “freeze” an image database during playback.
- m. Windows Viewing (Playback): The Central Station software shall view previously recorded image databases within viewing windows. These viewing windows shall have the following capabilities.
- n. Muliple View (1, 4 or 8 View): The Browser software shall have the ability to place 1, 4 or 8 video viewing windows upon the desktop. The user shall be able to select which image database to review by selecting the appropriate viewing windows (unrelated to Microsoft Windows®). Once the viewing window has been selected, the user shall have the ability to use all playback tools for the selected window. The software shall allow the playback of images in the eight windows to be synchronized so that the viewer sees images tied together.
- o. Maximizing Current Viewing Window: The Browser software shall have the ability of maximizing any image to the largest window.
- p. Image Enhancement: The Browser software shall be able to enhance images using tools such as zoom, sharpen, blur, etc.
- q. Zoom In: The Browser software shall have the ability to zoom in on an image a minimum of 4+ times.
- r. Zoom Out: The Browser software shall have the ability to zoom out of an image a minimum of 4+ times.
- s. Zoom to Window: The Browser software shall have the ability to shrink or enlarge an image to fit the size of the viewing window.
- t. Zoom to Image: The Browser software shall enable the user to view an image even if the image is larger than the window that it is being viewed in.
- u. Enhance: The Browser software shall have the ability to enhance an image.
- v. Sharpen: The Browser software shall have the ability to sharpen an image.
- w. Blur: The Browser software shall have the ability to blur or smooth an image.
- x. Restore: The Browser software shall have the ability to restore an image back to its pre-enhanced state.
- y. Brightness: The Browser software shall have the ability to increase or decrease the brightness of an image.
- z. Contrast: The Browser software shall have the ability to increase or decrease the contrast of an image.

- aa. Printing: The Browser software shall have the ability to print an image to a Windows® compatible printer with suitable graphics capabilities.
- bb. Print Preview: The Browser software shall have the ability to preview an image before printing.
- cc. Print Setup: The Browser software shall have the ability to specify printer and paper size, source and orientation for printing.
- dd. Page Layout: The Browser software shall have the ability to specify range of images and image size.
- ee. Save Image As: The Browser software shall have the ability to save an image as a browser image record, BMP or JPEG file to a specified drive or folder.
- ff. Send Image To: The Browser software shall have the ability to send an image to another recipient via e-mail.

21.7 System Upgrade

- a. The system's hardware and software shall be capable of being upgraded in the field. The upgrade shall be easy and user friendly.
- b. The DVR may be programmed with time, date, and vehicle I.D., as well as camera input and capture rate via keypad programming or Ethernet port.

22. **HEATING, DEFROSTING, VENTILATING & AIR CONDITIONING SYSTEMS**

22.1 System Characteristics

- a. A heating and ventilating system shall be provided with proper correlation to provide practical maximum comfort to passengers and the operator. Heating and ventilating system shall incorporate introduction of approximately twenty percent (20%) fresh air.
- b. Air for heating and ventilating shall be evenly distributed throughout the coach body in such a manner as to minimize temperature variation. Provision shall be made for minor adjustment of controls to maintain desired temperatures within the coach without changing supply of outside air required for ventilation.
- c. A manual control or modulating valve shall be provided to permit the fans to be used for power ventilation of outside air in warm weather.
- d. Main heating system shall be thermostatically controlled. The heating system shall provide heated, filtered air for an ambient temperature differential from sixty (60) degrees to zero (0) degree F. Heating filtering elements must be of the disposable type.
- e. All motors shall be MCC Brushless, or approved equal.
- f. Blower motor(s) shall be two-speed, heavy-duty with adequate output to provide circulation throughout the coach. Blowers shall also circulate fresh air throughout the coach.

- g. Main heater shall be mounted in the rear of the coach above the engine compartment. It shall be a hot water type with heavy-duty motors and a minimum capacity of 110,000 B.T.U. at 100-degree water-air temperature differential. A water shut-off valve shall be provided at the heater.

22.2 Driver's Heater

- a. A separate dash heater and blower shall be provided for the driver's comfort and for windshield defrosting. Capacity of 40,000 BTU output at 100-degree water-air temperature differential, is required.
- b. A two-speed blower, using a 24V, electric motor, shall be provided with air volume of 500 cfm minimum with separate switch and manual valve to control air flow.
- c. Defroster blower shall be automatically inoperative if the alternator is not charging.
- d. A 12V 5-blade defroster fan, with fan guard, shall be located in the lower left corner of the windshield area of the coach. Switch shall be mounted on the driver's console. SRTA to approve the location.

22.3 Heater Water Lines

- a. Heater water lines shall not be exposed within the coach.
- b. All water lines shall be heavily insulated throughout the coach. They shall be made of heavy-duty copper or brass, except where shock absorbing or flex lines are required.

22.4 Heater Cores

- a. All heater cores fins shall be of aluminum, and the heater core tubes shall be copper. Metal used in the tanks shall be of adequate thickness with drawn reinforcements. All radii of the tanks shall be of sufficient size to preclude fatigue failure.
- b. Heater cores, motor and fan must be readily accessible and installed to permit ready removal.

22.5 Heater and Blower Motors

- a. All blowers required for the heating and ventilating system shall be balanced statically and dynamically.
- b. All motors required for these blowers shall be heavy-duty type, motors three-eighth (3/8) horsepower minimum.

22.6 Heater Gradustat and Water Pump

Gradustat controlling the heating system shall be protected or screened to prevent tampering and guarded against any possible damage from passenger's feet. Location to be approved by the SRTA. Water supply to the heating system to be controlled by a modulating valve. The heater circulating water pump must be an minimum capacity of fifteen (15) gallons per minute.

22.7 Air Conditioning System

- a. The coach shall be equipped with a Thermo King Model T Series Coach Air Conditioning System with X426 Compressor and Clutch Assembly, or approved equal, designed to operate on 407C refrigerant. The T Series upper package mounts in a compartment in the rear area of the coach above the coach engine. The compressor/clutch assembly mounts in the engine compartment, and is belt driven from either the engine or transmission. If an alternator is also driven from the same PTO, then the compressor and alternator shall be driven by a single serpentine design belt.
- b. The air conditioning unit frame shall be constructed of 5052-H32 structural aluminum of .100 and .182 material thickness for strength, corrosion protection, and light weight. The frame shall be all welded and painted with a high solid polyester paint. All hardware shall be 300 Series stainless steel to protect against corrosion. "Neverseerz" anti-seizing lubricant shall be applied to the threads of all stainless steel hardware during unit assembly to prevent thread galling.
- c. The evaporator, heater and condenser coils shall be constructed of 3/8 inch outside diameter seamless Series 122 copper tubing having minimum .0195 inch wall thickness. The copper tubing shall be mechanically expanded into aluminum fins having a minimum thickness of .080 inch. The fin spacing shall be: evaporator and heater coils - 12 fins per inch; condenser coil - 10 fins per inch. The condenser coil shall be dipped in an acrylic base, polyvinyl material to provide a 2 mil thick coating of the entire exterior surface for corrosion protection and quick dirt release during washing. This coating shall not impair the performance of the air conditioning system. The condenser coil shall be mounted to allow easy removal and reinstallation without major disassembly of the unit frame or removal of the unit from the coach. Separate drains shall be provided for the condenser and evaporator/heater sections to allow moisture to be routed out of the unit to the street. Drain seals and/or traps shall be installed at the outlet of the evaporator/heater drain tubes to prevent entrance of dirt or fumes into the coach.
- d. The motors shall be wound magnet 27VDC, GE. The condenser shall have two motors; the evaporator/heater shall have one. Motors shall be selected and applied to maximize efficient operation, airflow and long life. Brush life shall be minimum of 10,000 hours of operating time. Motors shall be capable of two speed operation. Evaporator/heater motor shall operate at low speed during heat mode and high speed during cool, vent or reheat modes. Condenser fans shall be axial flow type with a steel spider, aluminum blades and aluminum hub. The fans shall be coated with high solid polyester paint for corrosion protection.
- e. Evaporator/heater blowers shall be 9" x 5", forward curve, single inlet centrifugal type. Regreasable, self-aligning outboard bearings shall support the blower shafts. Heavy duty, ring type flexible couplings shall connect the shafts to the motor.

22.8 Temperature and Electrical Controls

- a. There shall be a unitized control panel consisting of reliable electromechanical relays, magnetic motor circuit breakers, bi-metal control circuit breakers, adjustable return air thermostat with a range of 60° - 90° F, ambient thermostat, evaporator coil anti-freeze thermostat and terminal board for ease of troubleshooting.
- b. This control panel shall be located in the evaporator/heater return air area, or in an enclosed control box if mounted in an ambient location. The return air thermostat shall have a maximum tolerance from set point of 2.5° F.

22.9 Electrical Wiring and Terminals

All unit wiring shall be UL758, Style 3173/3196 having copper strands with tinned ally coating rated for up to 600 volts. The insulation shall be cross-linked polyethylene, rated for 125° C and shall be white in color with hot stamp number coding the entire length at a maximum spacing of 1-3 inches. All terminals shall be "forklok" or ring type with vinyl insulation. All terminals shall be machine crimped. Hand crimping is not acceptable. All terminations exposed to ambient shall be coated with glycol for corrosion protection.

22.10 Receiver Tank, Dry Eye, Filter/Dehydrator

The unit shall be equipped with a refrigerant receiver tank installed vertically to ensure a steady liquid feed to the expansion valve. The receiver tank shall meet all ASTM requirements and have two (2) sight glasses for checking refrigerant level. The top sight glass shall have a floating plastic ball to indicate proper refrigerant level. A refrigerant dry eye shall be provided in the liquid line, or in the lower sight glass of the receiver tank, to indicate the presence of moisture in the refrigerant system. The unit shall have a disposable liquid line filter/dehydrator.

22.11 Refrigerant Hoses, Copper Tubing, Fittings

- a. Suction and discharge hoses shall be provided to connect the air conditioning unit to the compressor. The hoses shall have reusable swivel fittings, Teflon liner, stainless steel interior support coil, stainless steel exterior braid, and asbestos exterior sleeve for abrasion protection. Length of such hoses shall be kept to a minimum to minimize effusion of refrigerant or permeation of moisture.
- b. All copper tubing provided shall be refrigeration grade, Series 122 seamless type meeting ASTM specifications. All solder joints shall be silver soldered. All flux and scale shall be cleaned from solder joints, prior to soldering, and all tubing exposed to ambient shall be sprayed with fungus proof varnish.
- c. All JIC and SAE swivel fittings of 3/4" flare size and larger shall include "O" rings for added sealing protection. "O" ring material must be compatible with refrigerant.

22.12 Expansion Valve

The expansion valve shall be externally equalized. It shall have a replaceable power head and cage assembly and be equipped with a 100 mesh screen at the inlet to prevent contaminants from plugging the seat. The superheat shall be factory set, requiring no field adjustment. The expansion valve bulb shall be clamped to the suction line in the evaporator compartment and insulated from effects of surrounding air temperature. The expansion valve body shall be properly secured and mounted in the return air area for ease of access.

22.13 System Performance

The T Series system shall control the interior coach temperature to meet all White Book temperature control performance requirements defined in Chapter 3.7, INTERIOR CLIMATE CONTROL, of the Department of Transportation URBAN MASS TRANSPORTATION ADMINISTRATION, BASELINE ADVANCE DESIGN TRANSIT COACH SPECIFICATIONS.

22.14 System Protective Controls

The air conditioning system will be equipped with the following protective control:

- (a) High pressure cutout switch.
- (b) Low pressure cutout switch.
- (c) Ambient sensing switch 45 + 5 F cutout 55 + 5 F cut-in.
- (d) These switches will interrupt the compressor energizing circuit. Both the high and low pressure switches will energize a trouble light at the driver's console.
- (e) High pressure relief valve.
- (f) Evaporator coil freeze protection - The system will be equipped with an evaporator pressure regulator or Anti-Freeze thermostat to prevent condensate freezing on the evaporator coil.

22.15 Compressor

- a. The air conditioning system shall be provided with a 4 cylinder, in-line V, 25.9 CID, reciprocating compressor. The compressor shall be capable of cycling on/off at any operating speed - no unloaders are to be used. It shall have aluminum body, heads and sump; free floating ring type suction valves, free floating ring type discharge valves with spring loaded cage to accept liquid slugging; two ball bearing mains, one on the front and one on the rear of the crankshaft for support; steel connecting rods with replaceable insert bearings on both ends; vanvsil alloy ringless pistons, replaceable cast iron cylinder sleeves; gerotor oil pump; 8.9 point oil sump. Synthetic 150 SUS oil shall be used. High and low refrigerant pressure cutout switches shall be mounted on the compressor. Suction and discharge service valves shall be made of brass, with steel stems.
- b. The compressor clutch shall be an electromagnetic design which utilizes a double row, open type ball bearing. The inner race of the ball bearing shall mount on the hub of the front compressor seal plate and shall be held in place by a locking nut. The outer race of the bearing shall be pressed into the pulley cavity and held in place by a snap ring. External Teflon grease seals mounted in the clutch pulley shall hold a large reserve of Exxon Unirex N2 high temperature grease, or approved equal, on both sides of the clutch bearing for maximum lubrication. The front seal shall have a grease zerk to conveniently enable bearing relubrication without disassembly of the clutch disc.
- c. The air gap between the clutch disc and mating pulley plate surface shall be adjustable. The clutch pulley plate shall be thick enough to allow for removal of .030 inch of material during resurfacing on a lathe during overhaul.

23. **BIKE RACKS**

- a. The Proposer shall install front mounted bicycle racks to each coach prior to delivery. The rack shall be a Sportworks Model 100156, or approved equal, including all necessary brackets, mounting hardware and bike retention accessories. A sensor manufactured by Sportworks which warns Operator the rack is deployed shall be provided. The warning indicator shall be located on the dash in a location approved by the SRTA.
- b. The Proposer shall advise, during the approved equal period, if the bike rack installation will impact the front headlights of the coach design to be offered and what, if any, modifications are necessary to accommodate the specified racks. The mounted bike rack shall not interfere with attaching towing equipment, accessing towing connectors or obstruct the driver's field of vision.

24. **BODY PREPARATION/PAINT AND DECALS**

24.1 Painting and Striping

- a. Color charts shall be furnished by the Contractor for SRTA approval, based on two (2) solid body colors exterior plus two (2) color stripes, and one (1) interior color.
- b. Both exterior and interior paint is to be Dupont low VOC, or approved equal. All paint shall be applied to a minimum thickness of six (6) mils.
- c. Exterior paint scheme is divided as follows:
 1. White B8951-HN. Basic bus plus front roof fairing.
Gold Metallic YM047-CP Cromax Pro Waterborne paint, or approved equal.
3.5" paint stripe all around bus plus gold mountain designs curbside/roadside.
Brown 44165-CP 12" high all around bus plus front mountain logo.
Black semi-gloss Dupont N5636-HN, or approved equal, behind window glass, across doors plus last panels curbside and roadside behind passenger windows.
 2. Black Hubs.
 3. Stripes to extend fully around the coach with sweep from below side window to encompass headlights. Exact location and scheme to be furnished by the SRTA to successful Proposer.
 4. The dash, side console, front and rear doors, and the front overhead ceiling shall be painted black.

24.2 Manufacturer's Emblems

Exterior manufacturer's emblem plate or decals shall not be installed.

24.3 Interior Signs

- a. All interior signs shall be supplied and installed in a metal, permanent plate design mounted to the body with rivets. All sign locations shall be reviewed by the SRTA and approved prior to installation.
- b. "No Smoking, No Eating, No Radios, No Drinking" plates shall be placed on the driver's modesty panel above the schedule rack. The plate shall be identical to the SRTA's current inventory. A sample shall be provided to the Contractor.
- c. Interior coach number in one (1) location (front header) shall be three inch (3"), plastic engraved type. Number sequence shall be furnished to the Contractor.
- d. Metal plate type decal explaining instructions for operating the wheelchair lift, and a metal plate explaining instructions for operating the kneeling system shall be installed at an approved location in the drivers compartment area.
- e. Metal plate type decal "No Standing Ahead of the Yellow Line", shall be located on front destination sign door in an approved location.

- f. Metal plate type decal "For optimum air conditioning, keep windows closed" to be located at the center horizontal window ledge between each window in locations approved by the SRTA. The SRTA shall provide a sample to the Contractor.
- g. Metal plate type decals for the chime system shall be provided at each window mullion and in appropriate areas at the wheelchair tie downs.
- h. All emergency exit instructions shall be metal plates installed in SRTA approved locations, or as required by law. The rear door "breakout" panel shall have the emergency instructions printed directly on the plastic panel in lieu of a metal plate.
- i. Metal plate type decal "Do not push on exit door" shall be located on each door leaf of the rear doors in a location approved by the SRTA.

24.4 Exterior Decals and Signs

- a. Exterior coach numbers in seven (7) locations shall be four inch (4") Scotchlite, reflective type material, or approved equal. Locations are listed below:

Bus Numbers:

Quantity: 1 per bus, Color: Black, Size: 4" high, Location: Interior-rear engine door.

Quantity: 5 per bus, Color: White, Size: 4" high, Locations: Roadside 2 numbers, curbside 2 numbers, front on Russett paint (over headlight).

Quantity: 1 per bus, Color: Black, Size: Each number 4" high – stacked, Location: Rear cap.

- b. "Diesel Fuel", to be located inside fuel filler door, manufactured of metal or plastic engraved.
- c. "Caution Water Hot", to be located inside surge tank filler door, manufactured of metal or plastic engraved.
- d. "Caution-Negative Ground", to be located inside battery compartment door as well as all necessary instructions to operate the battery disconnect switch(es), manufactured of metal or plastic engraved.
- e. "Battery Cut-off Switch Inside", manufactured of metal or plastic engraved, to be furnished and installed by the Contractor on the outside of the battery box compartment per sample provided by the SRTA.
- f. The International Handicapped Symbol shall be furnished and installed at one (1) approved location. This symbol must be the white symbol on a blue background, manufactured from 3M Scotchcal, or approved equal. Final size and location shall be designated and approved by the SRTA.
- g. Bus Numbers. Color: White Helvetica, Location: Interior Front Header (centered).
Color: Black Helvetica, Location: Aft side of interior air tank closeout to curbside of "Stop Request" sign.
- h. Passenger Rules Decal (required) "No Smoking, Eating/Drinking, Radio", Quantity: 2, Locations: (1) at rear bulkhead I/O panel door, (1) at AFT side of air tank enclosure below "Stop Request" sign.
- i. Video Surveillance Decals (required).
- j. "Exact Fare Please", manufactured from 3M reflective vinyl, or approved equal, decal shall be furnished and installed by the Contractor per the sample furnished by the

SRTA in an approved location.

- k. "Wheelchair Lift/Kneeling" decal, manufactured from 3M vinyl, or approved equal, shall be furnished and installed by the Contractor at the warning light in an approved location.

25. COMPRESSED NATURAL GAS (CNG)

25.1 CNG Engine

A. General Requirements:

1. The engine and transmission shall be heavy duty and mounted at the rear of the bus in order to allow maximum accessibility to all components.
2. Engine must be CARB certified CNG engine at the time of delivery.
3. The engine shall be OEM certified suitable for heavy heavy-duty urban transit bus application. The engine/transmission combination shall require application testing and approval from the respective engine and transmission manufacturer. Engine shall be capable of diagnostics, archive of failure data, adaptive learning and programming via a laptop PC in a "windows" environment. This capability shall extend to time stamping of failure data, running in a real time mode for road testing and data storage.
4. The operating range of the bus run in revenue service (Design Operating Profile) shall be at least 400 miles when fully secured to 3,600 PSI (nominal) of natural gas during a single fill-up.

5. The engine shall be capable of sending and receiving data via the J1939 communications standard.
- 25.2 CNG Fuel System
- A. Tanks:
1. The compressed natural gas (CNG) fuel tanks must be the lightest available tanks that meet all the standards that meet all the standards of NGV 2, NFPA 52, DOT, and provide a minimum of 21,000 SCF.
 2. Eight (8) Type III fuel tanks must be roof-mounted with tanks located as far outboard as possible. A walkway along the centerline of the roof must also be provided. This walkway will allow maintenance personnel to safely walk between the tanks with the fuel tank cowlings either opened or closed.
 3. The tanks must be a twenty (20) year tank and certifiable to twenty (20) years.
 4. Low-pressure regulators shall be installed so that the drain hole is at the bottom of the regulator, as they occasionally require draining.
 5. The high-pressure regulator shall be located so it is accessible for maintenance and adjustment.
 6. There shall be an emergency $\frac{1}{4}$ turn shut-off valve between the tanks and the fueling head, no higher than 68" to allow actuation while standing on the ground.
 7. The emergency relief valves on each cylinder shall have a vent pipe. The end of the pipe shall be covered with a plastic cap to prevent debris from entering, but still be capable of venting in case of emergency.
 8. A provision shall be provided to unload all of the fuel from the storage cylinders to a facility based low-pressure gas line or storage facility. Connection shall be accessible at the fueling fitting area and be properly protected and labeled. It shall be possible to unload a full load of fuel in thirty minutes or less.
- B. Fueling:
1. Fueling must take place on the right rear corner of the coach (curbside).
 2. Fuel door must have a minimum height from the ground to the door opening of 48."
 3. Fuel door must have a starter and engine cut-out switch installed to prevent starting or running the engine of the coach during fueling.
 4. Fueling must be able to be completed in less than five minutes from an empty state to a completely full state.
 5. There shall also be a de-fueling fitting and valve system to unload the fuel supply from the bus tanks.

Vehicle Technical Information

This form must be completed and included in the Technical Proposal.

GENERAL COACH DATA SHEET
30 FT. 102" Heavy Duty Bus

Bus manufacturer:	
Bus model:	
Understructure manufacturer:	
Model number:	

Basic Body Construction

Type:	
Tubing or frame member thickness and dimensions	
Overstructure	
Understructure	
Skin thickness and material	
Roof	
Sidewall	
Skirt panel	
Front end	
Rear end	

Dimensions

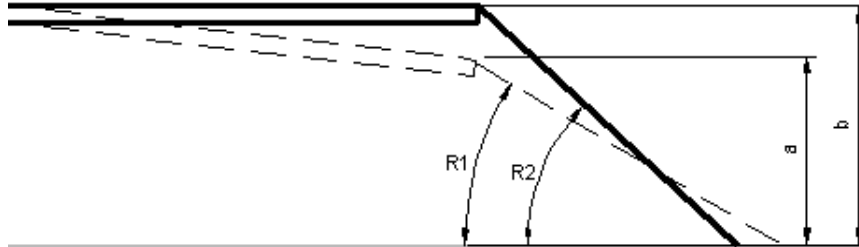
Overall length	Over bumpers	[] ft	[] in.
	Over body	[] ft	[] in.
Overall width	Over body excluding mirrors	[] ft	[] in.
	Over body including mirrors—driving position	[] ft	[] in.
	Over tires front axles	[] ft	[] in.
	Over tires center axle	[] ft	[] in.
	Over tires rear axles	[] ft	[] in.
Overall height (maximum)		[] ft	[] in.
Overall height (main roof line)		[] ft	[] in.

Angle of approach	[]	deg
Breakover angle	[]	deg
Breakover angle (rear)	[]	deg
Angle of departure	[]	deg

	Doorway Dimensions	Front		Rear
Width between door posts	[] in.		[] in.	

Door width between panels	<input type="text"/>	in.	<input type="text"/>	in.
Clear door width	<input type="text"/>	in.	<input type="text"/>	in.
Doorway height	<input type="text"/>	in.	<input type="text"/>	in.
Knuckle clearance	<input type="text"/>	in.	<input type="text"/>	in.

Step height from ground measured at center of doorway



	Front doorway, empty	Ramp angle	Rear Doorway, empty
Kneeled	a. <input type="text"/> in.	R1 <input type="text"/> deg	a. <input type="text"/> in.
Unkneeled	b. <input type="text"/> in.	R2 <input type="text"/> deg	b. <input type="text"/> in.

Interior head room (center of aisle)

Front axle location	<input type="text"/> in.
Center axle location	<input type="text"/> in.
Rear axle location	<input type="text"/> in.

Aisle width between transverse seats in.

Floor height above ground (centerline of bus)

At front door	<input type="text"/> in.
At front axle	<input type="text"/> in.
At drive axle	<input type="text"/> in.
At rear door	<input type="text"/> in.

Minimum ground clearance (between bus and ground, with bus unkneeled)

Excluding axles	<input type="text"/> in.
Including axles	<input type="text"/> in.

Horizontal turning envelope (see diagram below)

Outside body turning radius, TR0 (including bumper)

 ft

 in.

Front inner corner radius, TR1

 ft

 in.

Front wheel inner turning radius, TR2

 ft

 in.

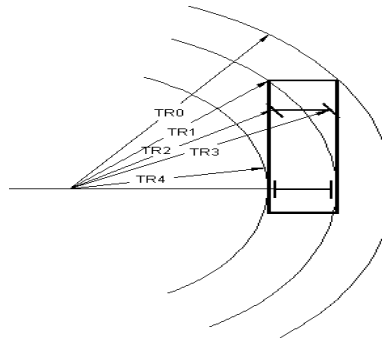
Front wheel outer turning radius, TR3

 ft

 in.

Inside Body Turning Radius innermost point, TR4 (including bumper)

 ft

 in.


Wheel base

Front in.

Rear in.

Overhang, centerline of axle over bumper

Front in.

Rear in.

Floor

Interior length

 ft

 in.

Interior width (excluding coving)

 ft

 in.

Total standee area (approximately)

 ft²

Minimum distance between wheelhouses:

Front in.

Rear in.

Center in.

Maximum interior floor slope (from horizontal) deg

Passenger capacity provided

Total maximum seating

Standee capacity

Minimum hip to knee room in.

Minimum foot room in.

Weight

	No. of people	Front axle			Center axle			Rear axle			Total bus
		Left	Right	Total	Left	Right	Total	Left	Right	Total	
Empty bus, full fuel and farebox											
Fully seated, full fuel and farebox											

Fully loaded standee and fully seated, full fuel and farebox											
Crush load (1.5x fully loaded)											
GVWR											
GAWR											

Engine, main

Manufacturer				
Type and weight rating				
Model number				
Bore		in.		
Stroke		in.		
Displacement		in. ³		
Compression ratio				
Injector type and size				
Net SAE horsepower		hp	at	RPM
Net SAE torque		lb/ft	at	RPM
Crankcase oil capacity				
New engine, dry		gal		
New engine, wet		gal		
Turbocharger make and model				
Maximum speed, no load		RPM		
Maximum speed, full load		RPM		
Speed at idle		RPM		
Speed at fast idle		RPM		

Engine information/graphs to be attached with this form:

- Engine speed vs. road speed
- Torque vs. engine speed
- Horsepower vs. engine speed
- Fuel consumption vs. engine speed
- Vehicle speed vs. time (both loaded and unloaded)
- Vehicle speed vs. grade (both loaded and unloaded)
- Acceleration vs. time
- Change of acceleration vs. time

Hybrid drive or transmission

Manufacturer				
Type				
Speeds				
Gear ratios	Forward:		Reverse:	
Shift speeds				
1st-2nd		mph		

2nd–3rd		mph
3rd–4th		mph
4th–5th (if applicable)		mph
5th–6th (if applicable)		mph

Fuel capacity (including heat exchanger and filters)

Voltage regulator

Manufacturer

Model

Voltage equalizer

Manufacturer

Model

Alternator

Manufacturer

Type

Model

Output at idle		amps
Output at maximum speed		amps
Maximum warranted speed		rpm
Speed at idle (approximately)		rpm

Drive type

Starter motor

Manufacturer

Type

Model

Air compressor

Manufacturer

Type

Rated capacity		CFM
Capacity at idle (approximately)		CFMs
Capacity at maximum speed (engine)		CFM
Maximum warranted speed		rpm
Speed idle		rpm

Drive type

Governor:

Cut-in pressure		psi
Cut-out pressure		psi

Axles

First

Manufacturer

Type		
Model number		
Gross axle weight rating		lbs
Axle load		lbs

Second

Manufacturer		
Type		
Model number		
Gross axle weight rating		lbs
Axle load		lbs

Third

Manufacturer		
Type		
Model number		
Gross axle weight rating		lbs
Axle load		lbs
Axle ratio		

Suspension system

Manufacturer		
Type:	First:	
	Second:	
	Third:	
Springs:	First:	
	Second:	
	Third:	

Joint

Manufacturer		
Type		
Model number		

Wheels and tires

Wheels

Make		
Size		
Capacity		
Material		

Tires

Manufacturer		
Type		
Size		

Load range/air pressure psi

Steering, power

Pump

Manufacturer and model number

Type

Relief pressure psi

Booster/gear box

Manufacturer and model number

Type

Ratio

Power steering fluid capacity gal

Maximum effort at steering wheel lbs (unloaded stationary coach on dry asphalt pavement)

Steering wheel diameter in.

Brakes

Make of fundamental brake system

Brake chambers vendor size and part number: First:

Second:

Third:

Brake operation effort

Slack adjuster's vendor's type and part numbers

First:	Right:	<input type="text"/>
	Left:	<input type="text"/>
Second:	Right:	<input type="text"/>
	Left:	<input type="text"/>
Third:	Right:	<input type="text"/>
	Left:	<input type="text"/>
Length:	First take-up:	<input type="text"/>
	Second take-up:	<input type="text"/>
	Third take-up:	<input type="text"/>

Brake drums/discs

First:	Manufacturer	<input type="text"/>
	Part number	<input type="text"/>
	Diameter	<input type="text"/> in.
Second:	Manufacturer	<input type="text"/>
	Part number	<input type="text"/>
	Diameter	<input type="text"/> in.
Third:	Manufacturer	<input type="text"/>
	Part number	<input type="text"/>
	Diameter	<input type="text"/> in.

Brake lining manufacturer	
Type	

Brake lining identification

First:	Forward	
	Reverse	
Second:	Forward	
	Reverse	
Third:	Forward	
	Reverse	

Brake linings per shoe

First	
Second	
Third	

Brake lining widths

First		in.
Second		in.
Third		in.

Brake lining lengths

First		in.
Second		in.
Third		in.

Brake lining thickness in.

Brake lining per axle

First		sq. in.
Second		sq. in.
Third		sq. in.

Cooling system

Radiator/charge air cooler

Manufacturer			
Type			
Model number			
Number of tubes			
Tubes outer diameter	<input type="text"/>	in./	<input type="text"/>
Fins per inch	<input type="text"/>	fins	
Fin thickness	<input type="text"/>	in.	
Total cooling and heating system capacity	<input type="text"/>	gal	
Radiator fan speed control			
Surge tank capacity	<input type="text"/>	quarts	

Engine thermostat temperature setting: Initial opening (fully closed) °F
 Fully open °F
 Overheat alarm temperature sending unit setting °F
 Shutdown temperature setting °F

Air reservoir capacity

Supply reservoir in.³
 Primary reservoir in.³
 Secondary reservoir in.³
 Packing reservoir in.³
 Accessory reservoir in.³
 Other reservoir type in.³

Heating, ventilation and air conditioning equipment

Heating system capacity BTU/hr
 Air conditioning capacity BTU
 Ventilating capacity CFM

Compressor

Manufacturer
 Model
 Number of cylinders
 Drive ratio
 Maximum warranted speed rpm
 Operating speed rpm (recommended)
 Weight lbs
 Oil capacity Dry gal
 Wet gal
 Refrigerant: Type lbs

Condenser

Manufacturer
 Model
 Number of fins/in.
 Outer diameter of tube in.
 Fin thickness in.

Condenser fan

Manufacturer
 Model
 Fan diameter in.
 Speed maximum rpm
 Flow rate (maximum) CFM

Receiver

Manufacturer		
Model		
Capacity		lbs

Condenser fan drive motors

Manufacturer		
Model		
Type		
Horsepower		hp
Operating speed		rpm

Evaporator fan drive motors

Manufacturer		
Model		
Type		
Horsepower		hp
Operating speed		rpm

Evaporator(s)

Manufacturer		
Model		
Number of rows		
Number of fins/in.		
Outer diameter of tube		in.
Fin thickness		in.
Number of evaporators		

Expansion valve

Manufacturer		
Model		

Filter-drier

Manufacturer		
Model		

Heater cores

Manufacturer		
Model		
Capacity		Btu/hr
Number of rows		
Number of fins/in.		
Outer diameter of tube		in.
Fin thickness		in.

Number of heater cores

Floor heater blowers

Front
Rear

Controls

Manufacturer
Model

Driver's heater

Manufacturer
Model
Capacity Btu/hr

Ventilation system

Type

Coolant heater

Make
Model
Capacity Btu

Interior lighting

Manufacturer
Type
Number of fixtures
Size of fixtures
Power pack

Doors

Front

Manufacturer of operating equipment
Type of door
Type of operating equipment

Rear

Manufacturer of operating equipment
Type of door
Type of operating equipment

Passenger windows

Front

Manufacturer

Model			
Type			
Number:	Side		
	Rear		
Sizes:			
Glazing:	Type		
	Thickness		
	Color of tint		
	Light transmission		

Mirrors

	Size	Type	Manufacturer	Part no.	Model no.
Right side exterior					
Left side exterior					
Center rearview					
Front entrance area					
Upper-right corner					
Rear exit area					

Seats

Passenger

Manufacturer	
Model	
Type	

Operator

Manufacturer	
Model and part number	
Type	

Paint

Manufacturer	
Type	

Wheelchair ramp equipment

Manufacturer		
Model number		
Capacity		lbs
Width of platform		in.
Length of platform		in.
System fluid capacity		quarts
Type of fluid used		
Operating hydraulic pressure		psi
Hydraulic cylinders:	Size	

Number

Wheelchair securement equipment

Manufacturer

Model number

Destination signs

Manufacturer

Type

Character length

Front destination

 in.

Front route

 in.

Curbside destination

 in.

Rear route

 in.

Character height

Front destination

 in.

Front route

 in.

Curbside destination

 in.

Rear route

 in.

Number of characters

Front destination

Front route

Curbside destination

Rear route

Message width

Front destination

 in.

Front route

 in.

Curbside destination

 in.

Rear route

 in.

Electrical

Multiplex system

Manufacturer

Model number

Batteries

Manufacturer

Model number

Type

Communication system

GPS

Manufacturer	
Model number	

PA system

	Manufacturer	Model number	Number
Amplifier			
Microphone			
Internal speakers			
External speaker			

Energy storage (hybrid drive)

Type		
Number of cells		V
Battery pack voltage		V
Weight		lbs

Security camera system

Manufacturer		
Model number		
Number of cameras		
Storage capacity		

Bike racks

Manufacturer	
Model number	

Fire detection system

Manufacturer		
Model number		
Fire detectors		
Type (thermal or optical)		
Number of detectors		

Automatic voice annunciator system

Manufacturer	
Model and part number	

Annunciator LED sign

Number of signs	
Housing dimensions	
Character length	in.

Character height in.
Character width in.

GPS antenna

Manufacturer
Model and part number

Automatic passenger counter

Manufacturer
Model and part number a.
b.
c.
Sensor type

Real-time bus arrival prediction system

	Manufacturer	Model number
Router	<input type="text"/>	<input type="text"/>
Cellular modem	<input type="text"/>	<input type="text"/>
Charge protection	<input type="text"/>	<input type="text"/>

Electronic tire pressure monitoring system

Manufacturer
Model number

Electronic brake stroke/wear indicator system

Manufacturer
Model number

NOTE: All information above is accurate to the timeframe upon submission. The Agency reserves the right to update above data if changes occur, upon consultation with the customer.