

Attachment A

TECHNICAL SPECIFICATIONS

Duluth Transit Authority

TECHNICAL EQUIPMENT SPECIFICATIONS

August 28, 2020

1.00 DEFINITIONS

Duluth Transit Authority Color Pattern:

The color scheme is green and blue stripe with smaller white reflective stripe between, on a white body. A paint scheme from our last production will be provided and posted on the DTA Website at www.duluthtransit.com.

Body Style

There are multiple body styles included in this RFP:

- Standard Bus Style similar to the current Duluth buses
- BRT Bus Style Curved front and rear body panels, a curved front windshield
- Coach Style an Intercity style bus typically for longer distances between cities

Respondents may propose on any or all of the above body styles. The DTA's standard bus is a box-style bus with square body panels and a split windshield.

Electronic Equipment:

Wiring for the Fareboxes shall be included; Fareboxes will be drop shipped to Duluth for installation by DTA. ITS equipment is required, Trapeze is the contractor. Wiring for the IT Specification is required.

Contact person: Nancy Brown at (218) 623-4329 or nbrown@duluthtransit.com.

- 1) **Standee Line:** A yellow line marked across the bus aisle in line with the driver's barrier to designate the forward area which passengers may not occupy when the bus is moving.
- 2) **Free Floor Space:** Floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area.
- 3) **Curb Weight:** Weight of vehicle, including maximum fuel, oil and coolant; and all equipment required for operation and required by their specification, but without passengers or driver.
- 4) **Seated Load:** One hundred fifty (150) pounds for every designated passenger seating position and the driver.
- 5) **Gross Load:** One hundred fifty (150) pounds for every designated passenger seating position, for the driver, and for each 1.5 square feet of free floor space.
- 6) **SLW (Seated Load Weight):** Curb weight plus seated load.
- 7) **GVWR (Gross Vehicle Weight Rate):** Curb weight plus gross load.
- 8) **Fireproof:** Materials that will not burn or melt at temperatures less than 2,000° F.
- 9) **Fire Resistant:** Materials that have a flame spread index less than 150 as measured in a radiant panel flame test per ASME-E 162-75.
- 10) **Design Operating Profile:** The operating profile for design purposes shall consist of simulated

transit type service. The duty cycle is described in the figure "Transit Coach Duty Cycle." The duty cycle consists of three phases to be repeated in sequence: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph, an arterial route phase of 2 miles with 2 stops per mile and a top speed of 40 mph, and a commuter phase of 4 miles with 1 stop and a maximum speed of 55 mph and a 5 minute idle phase.

Phase	Stops/ Mile	Top Speed (mph)	Miles	Accel. Dist. (ft.)	Accel. Time (s)	Cruise Dist. (ft.)	Cruise Time (s)	Decel. Rate (fpsps)	Decel. Dist. (ft.)	Decel. Time (s)	Dwell Time (s)	Cycle Time (min-s)	Total Stops
CBD	7	20	2	155	10	540	18.5	6.78	60	4.5	7	9-20	14
Idle	-	-	-	-	-	-	-	-	-	-	-	5-0	-
Arteri al	2	40	2	1035	29	1350	22.5	6.78	255	9	7	4-30	4
CBD	7	20	2	155	10	510	18.5	6.78	60	4.5	7	9-20	14
Arteri al	2	40	2	1035	35	1350	22.5	6.78	255	9	7	4-30	4
CBD	7	20	2	155	10	510	18.5	6.78	60	4.5	7	9-20	14
Com muter	1 stop for phase	Max. or 55	4	5500	90	2 miles + 4580 ft.	188	6.78	480	12	20	5-10	1
\			14									47-10	51

Average Speed -
17.8 mph

CLASSES OF FAILURES

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

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

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

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

MAINTENANCE PERSONNEL SKILL LEVELS

- (a) "A" - Journeyman or Class A Mechanic
- (b) "B" - Service Mechanic or Class B Serviceman
- (c) "Cö" - Mechanic
- (d) "Utility" - Servicer, Cleaner, Fueler, Oiler, Miscellaneous

1.01 ABBREVIATIONS

ASTM	American Society For Testing and Materials
SAE	Society of Automotive Engineers
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
SPI	Society For The Plastics Industry
USDHHS	United States Department of Health and Human Services
JIC	Joint Industrial Council
BMCS	Bureau of Motor Carrier Safety
FMVSS	Federal Motor Vehicle Safety Standards
ADA	Americans With Disabilities Act

1.02 LEGAL REQUIREMENTS

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

The Contractor shall comply with all applicable Federal, State and Local regulations. In the event of any conflict between the requirements of these specifications and any applicable legal requirement, then the legal requirement shall prevail.

The DTA will require a Buy America Pre-Award audit to be completed on the base bus prior to award in compliance with FTA requirements. Each participant on the Master Contract will separately request a pre-award audit on the specific configuration awarded, as may be required by FTA.

1.03 General

1) General Dimensions

Length Overall	40 feet (between 38.5 and 41.6 feet)
Width Overall	up to 102 inches, ADA platform must move through the front entry of the bus.
Height Overall	up to 120.7 inches
Seating Capacity	up to 36 with two wheelchair positions
Step Height From Ground - front	Maximum 12.5 inches kneeling. 15 inches normal
Step Height From Ground - rear	16.25 inches
Turning Radius - body corner	45.2 feet maximum

	40-foot bus	35-foot bus	30-foot bus
Length Overall	40 feet (between 38.5 and 41.6 feet)	35 feet +/- 1 foot	30 feet +/- 1.6 feet
Width Overall	up to 102 inches, ADA platform must move through the front entry of the bus.	up to 102 inches, ADA platform must move through the front entry of the bus.	up to 102 inches, ADA platform must move through the front entry of the bus.
Height Overall	up to 120.7 inches	up to 120.7 inches	up to 120.7 inches
Seating Capacity	Minimum 38 with two wheelchair positions unoccupied	Minimum 30 with two wheelchair positions unoccupied	Minimum 23 with two wheelchair positions unoccupied
Step Height From Ground - front	Maximum 12.5 inches kneeling. 15 inches normal	Maximum 12.5 inches kneeling. 15 inches normal	Maximum 12.5 inches kneeling. 15 inches normal
Step Height From Ground - rear	16.25 inches	16.25 inches	16.25 inches
Turning Radius - body corner	45.2 feet maximum	39 feet maximum	34.5 feet maximum

- 2) **Service Life:** The bus shall be designed to operate in transit service for at least 12 years or 500,000 miles. It shall be capable of operating at least 40,000 miles per year including the 12th year.
- 3) **Mean Mileage Between Failures:** The following are design goals for mean mileage between failures by failure class, provided that specified preventative maintenance procedures are followed.
- (a) *Class 1 - Physical Safety:* mileage shall be greater than 1,000,000 miles.
 - (b) *Class 2 - Road Call:* mileage shall be greater than 20,000 miles.
 - (c) *Class 3 - Bus Change:* mileage shall be greater than 16,000 miles.

(d) *Class 4 - Bad Order:* mileage shall be greater than 10,000 miles.

- 4) ***Accessibility:*** All systems or components serviced as part of periodic maintenance, or whose failure may result in Class 1 or Class 2 failures shall be readily accessible for service and inspection. To the extent practical, removal or physical movement of components unrelated to the specific maintenance and/or repair tasks involved shall be unnecessary. Relative accessibility of components, measured in time required to gain access, shall be inversely proportional to frequency of maintenance and repair of the components.
- 5) ***Interchangeability:*** Components with identical functions shall be interchangeable to the extent practical for each production run. These components shall include passenger window hardware, interior trim, lamps, lamp lenses and seat assemblies. Components with non-identical functions shall not be, or appear to be, interchangeable. **This applies to buses in each run.**
- 6) ***Conformity:*** All units or parts not specified shall be manufacturer's standard units. In all cases, material and dimensions must be furnished as specified unless an approved deviation is granted.

1.04 SHELL

- 1) ***Design:*** The bus shall have a clean, smooth, simple design, primarily derived from bus performance requirements and passenger service criteria. The exterior and body features, including grilles and louvers, shall be shaped to allow complete and easy cleaning by automatic bus washers without snagging washer brushes. Water and dirt shall not be retained in or on any body feature to freeze or bleed out onto the coach after leaving the washer. Body and windows shall be sealed to prevent leaking of air, dust, or water under normal operating conditions and minimize leakage during cleaning in automatic bus washers for the service life of the coach. Accumulation on any window of the coach of spray and splash generated by the coach's wheels on a wet road shall be minimized.
- 2) ***Materials:*** Body materials shall be selected and the body fabricated to reduce maintenance, extend durability, and provide consistency of appearance throughout the life of the coach. Detailing shall be kept simple; add-on devices and trim shall be minimized and, where necessary, integrated into the basic design.
- 3) ***Finish and Color:*** All exterior surfaces shall be smooth and free of visible wrinkles and dents. Exterior surfaces to be painted shall be properly cleaned and primed as appropriate for the paint used, prior to application of paint to assure a proper bond between the basic surface and successive coats of original paint. Paint shall be applied smoothly and evenly with the finished surface free of dirt, runs, orange peel, and other imperfections. All exterior finished surfaces shall be impervious to diesel fuel, gasoline, and commercial cleaning agents. Finished surfaces shall not be damaged by controlled applications of commonly used graffiti-removing chemicals. All exterior paint will be of the "wet look" type such as PPG, PPG Concept, or approved equal. Colors and paint schemes will be determined after the award of contract. White gel coated panels are acceptable. New Flyers Paint Standards are acceptable.
- 4) ***Numbering and Signing:*** Monograms, numbers, and other special signing specified by the

Procuring Agency shall be applied to the inside and outside of the bus as required. Signs shall be durable and fade, chip, and peel resistant; they may be painted signs, decals, or pressure sensitive appliqué. At least one sign shall be provided on each side of the coach interior to indicate that seats at the front are priority seats for elderly and handicapped passengers.

Front coach numbers shall be control tack type reflective decals, 3-inch size, Black, in color, centered below the belt line. Side coach numbers shall be control tack type reflective decals, 4-inch size, black in color, mounted at each side of the rear of the coach, centered on the belt line.

Coach numbers shall also be located on the roof; each number shall be at least 36 inches high, 36 inches wide and 4 inches wide. 30-inch high coach numbers are acceptable on the hybrid buses.

Rear coach numbers shall be 4-inch, white in color control tack type reflective decals, placed near the left upper rear of the coach. Engine compartment coach numbers shall be 3-inch, white in color, control tack type reflective decals mounted vertical on a black bracket on the left cradle hanger assembly or on power supports. Duluth bus numbers will be from 22XX to 22XX.

Bus manufacturer shall provide dimensional drawings showing the location, size, and orientation of the lettering and signage at the pre-production meeting.

- 5) ***Pedestrian Safety:*** Exterior protrusions greater than 1/2-inch and within 80 inches of the ground shall have a radius no less than the amount of the protrusion. The left side rear-view mirror ad frames, and required lights and reflectors are exempt from the protrusion requirement. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize the ability of unauthorized riders to secure footholds or handholds.
- 6) ***Passenger Windows:*** A minimum of 20,000 square inches of window area, including door windows, shall be required on the standard configuration 40-foot coach. Minimum required area on the 35-foot coach shall be 16,000; minimum required area on the 30-foot coach shall be 14,000.
- 7) ***Passenger Doors:*** Two doors shall be provided in the right side of the bus for passenger ingress and egress. The front door shall be forward of the front wheels and located so that the driver is able to collect or monitor the collection of fares. The rear door shall be forward of the rear axle. An option shall be provided to omit the rear door.

1.05 Body Structure

- 1) The basic frame structure shall be a semi (or full)-monocoque design or approved equal. The DTA requires a stainless steel (304) chassis. The structure shall feature full length longitudinal members throughout, with cross-members, pillar, roof bows and bulkheads. The total girder type structure shall be designed for maximum strength, reliability and durability. All joints shall be welded. Options will also be accepted for a fully welded and stainless-steel structure.

The DTA will accept as an option as shown on the bid sheet carbon steel chassis with the following provisions:

The warranty on carbon steel welded structure will be 12years/500,000 miles (whichever occurs first) 100% parts and labor, should a failure occur (this supersedes warranty requirements elsewhere in the specification documents).

The corrosion and structural integrity guarantee covers against a significant loss of structural integrity of the assembly or its functional performance, resulting from a pertinent loss of cross-section due to corrosion caused by normal environmental elements as well as commonly used de-icers on owners streets.

The Contractor shall inspect the vehicles at three years, six years, and nine years and provide the owner with all material(s) needed to maintain this warranty.

The Contractor will be responsible for the labor costs incurred by the owner with any additional applications or modifications as per above.

The body assembly shall be modular and comprised of lightweight and corrosion resistant aluminum and composite materials. The body frame assembly shall be of modular bolt-together industry proven aluminum construction. This type construction allows similar attachment of various body modules, as well as interior and exterior accessories and handrails, without the structural compromise or potential water leaks of drilled holes. Vertical and horizontal aluminum extrusion framing members shall be joined by a keyed aluminum casting with precision angles and using the bolted compression method. Drilled holes or welds shall not be used in joining these members.

The body attachment to the chassis shall be directly to the chassis, with the main attachments in the heavy steel side impact section of the chassis. In order to achieve maximum strength, maximum durability, and close-tolerance alignment, all body attachments shall be by high strength steel treated bolts, and/or shims as required. Special care shall be given to insulate the aluminum body from the stainless steel chassis to discourage galvanic action.

- 2) ***Strength and the Fatigue Life:*** Under conditions of transit service throughout the service life of the bus, the basic structure shall withstand fatigue damage that is sufficient to cause Class 1 or Class 2 failure. The structure shall also withstand impact and inertial loads due to street travel throughout the bus' service life without permanent deformation or damage. Material: Reinforced glass fiber and plastic materials will be excluded from the structural body construction, except for replaceable panels, doors, coverings for the structural body, and except that steel reinforced glass fiber wheel-wells are permitted. Fiberglass caps in the front and rear are permissible; 0.18-inch-thick fiberglass exterior roof panels are acceptable.

Reinforced glass fiber and plastic materials will be excluded from the structural body construction, except for replaceable panels, doors, coverings for the structural body, and except that steel reinforced glass fiber wheel-wells are permitted. Fiberglass caps in the front and rear are permissible.

Ceiling trim panels shall be melamine or equal, 1/8-inch minimum thickness, in color specified by the purchaser.

- 3) ***Distortion:*** The bus at GVWR and under static conditions shall not exhibit deformation or deflection that impairs operation of doors, windows, or other mechanical elements. Static

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

- 4) **Resonance:** All structure, body, and panel-bending mode frequencies, including vertical, lateral, and torsional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible, or sensible resonant vibrations during normal service.
- 5) **Corrosion:** All Offerors should be aware of the harsh climate the DTA operate in and therefore its extreme concern with the corrosion resistant properties of the coach. The coach must resist corrosion from atmospheric conditions and road salts. It will maintain structural integrity and nearly maintain original appearance throughout its service life, provided it is maintained in accordance with the procedures specified in the service manual by the DTA. Materials exposed to the elements and all joints and connections of dissimilar metals will be corrosion resistant and will be protected from galvanic corrosion. Before assembling, all metal body parts will be given a thorough anti-corrosion treatment. The main welded structures (under - structure, roof, sides and, ends) are to be joined to make a complete welded structure. Threaded holes must be plugged to prevent damaging threads. The entire joined structure will then be blasted to a surface finish of SSPC - SP6 to give the metal an aggressive profile and to remove oil, grease, mill scale, and rust. All lap joints are to be sealed to prevent moisture to creep into areas where the primer will not reach.

The entire structure will then be primed. The manufacturer shall be responsible for all damage caused by corrosion for the first seven years of use on the chassis. This includes all parts and labor.

The understructure will then be coated with a wax based, self-healing coating applied to give an extra layer of resistant to sound and stone chipping.

Underbody components, roof tanks and plywood flooring are to be installed after treatment is completed.

The coach is then raised and asphalt based mastic will be applied to the underbody.

Proposers may offer equals to the DTA requirements under this section. But all proposers are required to meet all the DTA's requests for corrosion **or** to strongly support their proposal by either providing themselves or paying the DTA to replace parts, and recoat as necessary at 3, 6, and 9 years of life for the vehicle. E coating of the radiator, hydraulic cooler, and air-to-air after cooler is required.

Upon request, all Proposers shall submit test results using ASTM Procedure B-117 of a 336-hour (2-week) salt spray test of all structural components that shows no structural detrimental effects to visible surfaces, and no weight loss over 1 percent.

Undercoating is not required for stainless steel chassis.

Radiators and air-to-air coolers that are E-coated are acceptable, as is a hydraulic cooler core made of aluminum with an electrostatic epoxy plastic powder coated steel housing.

- 6) **Jacking:** Jacking from a single point shall permit raising the bus sufficiently high to remove

and reinstall a wheel and tire assembly. Jacking pads or points located on the axle **or** suspension near the wheels shall permit easy and safe jacking with the flat tire or dual set on a 6-inch high run-up block not wider than a single tire. Jacking and changing any one tire shall be completed by a 2M serviceman in less than 30 minutes from the time the bus is approached. The bus shall withstand such jacking to a height sufficient to change a wheel **or** 18 inches whichever is less at any one or any combination of wheel locations without permanent deformation or damage. New Flyer's standard repair times manual is approved.

- 7) **Hoisting:** The bus axles or jacking plates shall accommodate the lifting pads of a 2-post hoist system. Jacking plates, if used as hoisting pads, shall be approximately 5 inches square or round, with a turned-down flange not less than 1 inch deep on each side to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.
- 8) **Fire Protection:** The passenger and engine compartments shall be separated by a bulkhead(s) which shall, by incorporation of fire-resistant materials in its construction, be a firewall. This firewall shall preclude or retard propagation of an engine compartment fire into the passenger compartment. Only necessary openings shall be allowed in the firewall, and these shall be fire resistant. Any passageways for the climate control system air shall be separated from the engine compartment by fireproof materials. Piping through the bulkhead shall have copper, brass, or fire-resistant fittings sealed at the firewall with copper or steel piping on the forward side.

Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the firewall. The conduit and bulkhead connectors shall be sealed with fireproof material at the firewall. Engine access panels in the firewall shall be fabricated of fireproof material and secured with fireproof fasteners. These panels, their fasteners, and the firewall shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the firewall. Fire protection systems must meet or exceed FMVSS 302. Firewalls made of high tensile steel are approved. New Flyer's standard aluminum bulkhead connectors are approved.

- 9) **Towing:** Towing devices shall be provided on each end of the bus. The towing devices when used with a load equalizing sling shall withstand, without permanent deformation, tension loads up to 1.2 times the curb weight of the bus within 20° of the longitudinal axis of the bus. The rear towing device(s) shall not provide a toehold for unauthorized riders. The front towing devices shall allow attachment of a rigid tow bar and shall permit flat towing of the bus, at curb weight, by the towing devices and the tow bar. Each towing device shall accommodate a crane hook with a 1-inch throat. **The DTA does not intend to tow from the rear except for very short distances (as in out of a ditch or soft pavement). All major towing is intended to be done from the front with a tow bar.**

New Flyer's standard towing procedure is accepted.

- 10) **Crashworthiness:** The bus body and roof structure shall withstand a static load equal to 150% of the curb weight evenly distributed on the roof with no more than a 6-inch reduction in any interior dimension. Windows shall remain in place and shall not open under such a load. The bus 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 bus with no more than 3 inches of

permanent structural deformation at seated passenger hip height. This impact shall not result in sharp edges or protrusions in the bus interior. Exterior panels below the rubrail and their supporting structural members shall withstand a static load of 2,000 pounds applied perpendicular to the bus anywhere below the rubrail by a pad no larger than 5 square inches. This load shall not result in deformation that prevents installation of new exterior panels to restore the original appearance of the bus. A rubrail is not required.

- 11) **Leakage Test:** All buses covered by this specification shall, during the course of their manufacture, be subjected to a water test by the manufacturer to determine body leaks. Manufacturer shall take the necessary corrective action when body leaks are found to exist and conduct a second water test to recheck following corrective action.
- 12) **Rain Gutters:** Gutters shall be provided to prevent water flowing from the roof onto the side windows and passenger doors. When the bus is decelerated, the gutters shall not drain onto the windshield, or driver's side window, or into the door boarding area. Cross sections of the gutters shall be no less than 0.25 square inches.
- 13) **License Plates:** License plate provisions at the rear of the bus shall be recessed or surface mounted, there will be two rear positions and one front position. The DTA requires two rear positions to hold both the Minnesota and Wisconsin plates. Other purchasers require one or no license plates positions or holders.
- 14) **Rubrails:** Rubrails composed of black, flexible, resilient rubber-like material will be provided to protect both sides of the coach body from damage caused by minor sideswipe accidents with automobiles. Rubrails will have vertical dimensions of no less than 1 ½ inches with the centerline no higher than 33 inches above the ground. The rubrail will be capable of withstanding impacts as required in the FTA White Book crash test. The rubrail may be discontinued at doorways. A damaged portion of the rubrail will be replaceable without requiring removal or replacement of the entire rubrail. **Rubrails are NOT required.**

1.06 Interior

- 1) **Headroom:** Headroom above the aisle and at the centerline of the aisle seats shall be no less than 78 inches. At the centerline of the window seats, headroom shall be no lower than the required top of the side window. Headroom at the back of the rear bench seat may be reduced to a minimum of 56 inches, but it shall increase to the normal ceiling height at the front of the seat cushion. In any area of the bus directly over the head of a seated passenger and positioned where a passenger entering or leaving the seat is prone to strike his/her head, padding shall be provided on the overhead panelling.

New Flyer's configuration in the rear upper area to have an interior headroom of 76 inches and for the centerline of the window seats to have the headroom no lower than 61 inches is approved. Headroom shall be a minimum of 48 inches when measured from the rear-most sitting area of the rear bench seat to the PLC enclosure directly above. The access panel directly above the rear bench does not require padding.

Driver Barrier: A barrier or bulkhead of 1/4-inch thick double faced matte black melamine or equal, between the driver and the left front passenger seat shall be provided. The barrier

shall eliminate glare and reflection in the windshield directly in front of the barrier from interior lighting during night operation. The barrier shall extend from the top of the interior left-hand wheelhouse cover, to within 1-inch of the ceiling and shall fit the bus side windows and wall to prevent passengers from reaching the driver or his personal effects. Painted steel is acceptable.

This partition will be constructed of an approved piece of thermoformed 1/4-inch-thick No. 2370 bronze tinted polycarbonate material, or an approved painted aluminium panel and an approved 1/4-inch grey tinted polycarbonate. A metal coat hook and securing straps for the operator's jacket will be provided on the driver's barrier. Both Bronze tint and grey tinted DuPont SAR are acceptable. The San Diego barrier is the style requested. Aluminum in a dull matte finish is also an acceptable material. A diagnostic station also is acceptable.

- 2) ***Driver Security Barrier*** A full-length Driver Security Barrier with extended glass to act as a barrier between the driver and passengers entering the bus shall be installed between the driver seat and the farebox mount. The barrier shall be constructed of scratch resistant anti-glare glass or plexiglass that permits unobstructed view of the curbside mirror. Door hinges must be stainless steel piano hinges and the latch must be easily operated from the interior of the driver compartment. The door must include a non-motorized extended glass sliding window that can be easily operated with one hand and be lockable from the inside. Arrow Guard is an approved barrier.
- 3) ***Modesty Panels:*** Sturdy divider panels constructed of 1/4-inch double faced Parliament Walnut melamine, vacuum formed plastic, or 3/8-inch thick 14% Graylite Lexan complementing the interior trim shall be provided at the front and rear of the rear door. Modesty panels may be installed at the sides of longitudinal seats when the required armrests are integral. These dividers shall be mounted on the sidewall and shall project toward the aisle no further than passenger knee projection in longitudinal seats or the aisle side of the transverse seats. Modesty panels shall extend no higher than the lower daylight opening of the side windows and those forward of transverse seats shall extend to within 1/4 = 1/4-inch of the floor. Panels forward of longitudinal seats shall extend to below the level of the seat cushion. Dividers positioned at the exit doors shall provide no less than a 2 1/4-inch clearance between the modesty panel and the opened door to protect passengers from being pinched. The modesty panel and its mounting shall withstand normal kicking, pushing, and pulling loads of 200-pound passengers without permanent visible deformation.

Modesty panels shall at a minimum be located aft of the front door opening (full-height above the curb side wheelhousing); ahead of the rear door opening, aft of the rear door opening, and across the front of the upper deck where necessary to provide modesty and safety to seated passengers.

New Flyer's modesty panels that extend about 6-inches higher than the daylight opening of the side windows are accepted, as are side windows in the lower platform located 33-inches above the floor. Longitudinal seats in the lower deck will be provided with armrests without closeouts and longitudinal seats on the upper deck will be provided with armrests with closeout panels. Armrests are not integrated with the modesty panels.

1.07 Floor

- 1) **Material:** Composite Floor is required ó wood products are not acceptable. Stainless steel screws shall be used to set flooring, along with adhesive. Silkaflex is an approved adhesive.

The floor is secured to the structure using adhesive and tapping screws outside of the main rails (center aisle). Down the center aisle the fasteners in tapping plates are used on every 12-inch centers every 24 inches longitudinally (every floor support). Silkaflex adhesives are acceptable

- 2) **Strength:** The floor deck may be integral with the basic structure or mounted on the structure securely to prevent chafing or horizontal movement. Sheet metal screws shall not be used to retain the floor and all floor fasteners shall be serviceable from one side only. Tapping plates used for the floor fasteners shall be no less than the same thickness as a standard nut, and all floor fasteners shall be secured and protected from corrosion for the service life of the bus. The floor deck shall be reinforced as needed to support passenger loads at GVWR. The floor shall have an elastic deflection of no more than 0.60-inch from the normal place. The floor shall withstand the application of 2.5 times gross load weight without permanent detrimental deformation. Floor and step treads, with covering applied, shall withstand a static load of at least 150 pounds applied through the flat end of a 1/2-inch diameter rod, with 1/32-inch radius, without permanent visible deformation.

- 3) **Slope:** The floor shall be a continuous flat plane from the entrance at the front of the vehicle to the rear exit door, except at the wheel housings, but it shall not interfere with the passenger seating. The floor design shall consist of two levels (bi-level construction). Aft of the rear door position extending to the rear settee riser, the floor height may be raised to a height approximately 18 inches above the lower level. The slope may not exceed 3.5% for any distance greater than 14 inches.

An increase slope shall be allowed on the upper level not to exceed 3-1/2 degrees off the horizontal along the front-to-back axis of the bus. New Flyer's sloped floor transition at front entrance and exit doors to have lower step heights is approved. Also the floor sloped at front axle about 2 degrees and at upper deck about 5 degrees to accommodate Voith transmission is approved.

- 4) **Edges:** Where the floor meets the walls of the bus the surface edges shall be blended with a circular section of radius not less than 1/4- inch, and a moulding or cover shall prevent debris accumulation between the floor and wheel housings. All interior mouldings shall be smooth and free of sharp edges and designed to last the life of the vehicle. The cut edges and bottom are sealed with a polyurethane sealant to prevent deterioration by rot, fungus, etc. The upper flooring may be butt jointed.
- 5) **Floor Protection:** The floor, as assembled, including the sealer, attachments and covering shall be waterproof, non-hygroscopic, resistant to wet or dry rot, resistant to mould growth and impervious to insects.
- 6) **Fastening:** Interior panels shall be attached so that there are no exposed edges or rough surfaces. Panels and fasteners shall not be easily removable by passengers.

Interior trim fasteners, where required, shall be rivets, cross-recessed head screws, or tamper proof screws.

- 7) **Access Openings:** These openings in the floor shall be sealed to prevent entry of fumes and water into the bus interior. Flooring materials shall be flush with the floor and shall be edge-bound with stainless steel to prevent the edges from coming loose. Access openings shall be non-symmetrical so that the ribs of reinstalled flooring shall be properly aligned. Fasteners shall tighten flush with the floor. Flooring materials to be edge-bounded with stainless steel or aluminum where necessary. Stainless steel is preferred to deter corrosion. Replacement parts must be available for hatch and latches.

1.08 WHEELHOUSING

- 1) **Construction:** Front wheelhousings shall be constructed of molded fiberglass or 14 gauge or 16-gauge 304 stainless steel. Rear wheelhousings shall be constructed of 14 or 16-gauge stainless steel. Wheelhousings as installed and trimmed, shall withstand impacts of a 2-inch steel ball with at least 200-foot pounds of energy without penetration. Lower portion trim shall be unpainted stainless steel only. If metal is used in construction of the wheelhousing, it shall be covered on the interior by the same material as the floor covering.
- 2) **Splash Aprons:** Splash aprons of 1/4-inch thick fabric reinforced rubber shall extend to within 3-inches of ground. The front aprons shall be installed either behind or in front of the front wheels. Rear splash aprons installed behind the rear wheels may be sectional but shall extend full width of coach to protect all rear compartments from road splash. Splash aprons and their attachments will not be included in the road clearance measurements. Front wheelhousings shall also have a brush to minimize splashing.
- 3) **Fender Skirts:** Fender skirts shall be applied to exterior contour of wheelhouses for finished appearance and to control wheel splash. They may extend beyond allowable vehicle width if they are flexible. Tires are removed without removal of skirts.

1.09 DOORS

- 1) **Materials:** Structure of the doors, their attachments, inside and outside trim panels, and any mechanism exposed to the elements shall be durable and corrosion-resistant. Door construction shall be of extruded aluminium with bonded single skin construction. The doors, when fully opened, shall provide a firm support (grab-bar) and shall not be damaged if used as an assist by passengers during ingress or egress. They will be a bi-fold style door. Slide-glide type doors are acceptable as are rear swing outdoors.
- 2) **Front Door:** Front entrance door on right-hand side ahead of front wheel shall be two section Vapor slide-glide type, swing out or approved equal. The clear opening inside grab rails shall be at least 40-inches wide and 76.1 inches high with the door open. Mating edges shall be of the overlapping type and provide a minimum of 4 inches between the metal door edges.

New Flyerø Ameriview bolted door panels are approved equals.

- 3) **Rear Door:** Rear exit door on right-hand side ahead of rear wheels shall be a two section Vapor Slide glide or swing type door or approved equal with clear opening of at least 34 inches wide. The doors shall have pneumatic sensitive edges for safety protection as well as touch bars for passenger operation. Door height shall be a minimum of 75.1 inches. An option for deletion of the rear door shall be provided on the 35-foot buses. An option for 48-inch door shall be provided on DTA vehicles.
- 4) **Glazing:** Both rear and front doors shall have full length glazing in all door panels. The rear door may have split glazing. Glazing shall be 1/4-inch (6 mm) laminated safety glass.
- 5) **Projection:** Exterior projection of the doors shall be minimized and shall not exceed 19-inches during the opening or closing cycles or when doors are fully opened. Projection inside the coach shall not exceed 20 inches. The doors, when closed, shall be effectively sealed and the hard surfaces of the doors shall be at least 4 inches apart. Pantographic type rear doors are not acceptable. A brush-type gap filler shall be provided at the bottom edge of all doors to reduce the entry of wind, dirt, and water. Projecting portion of doors shall not extend below the top of the interior bus flooring (MVTA requirement).
- 6) **Control:** Front and rear doors shall be fully air operated with pneumatic door engine, with a five-position door control valve with single lever handle operating in a horizontal plane.

Operation of, and power to, the passenger doors shall be completely controlled by the driver. Rear door shall also open via the Vapor Class System or approved equal or via passenger-controlled touch bars. Doors shall open or close completely in 1.5 to 3.0 seconds from the time of control actuation and shall be subject to adjustment requirements of Subsection (8). A control or valve in the driver's compartment shall shut off the power to, and/or dump the power from, the front door mechanism to permit manual operation of the front door with the coach shut down. A master door switch which is not within reach of the seated driver shall when set in the "Off" position, close the doors, deactivate the door control system, release the interlocks and permit only manual operation of the doors. There will be a rear door override that will allow the opening of the door and allowing it to stay open when the bus is not in operation.

To preclude movement of the bus, an accelerator interlock shall lock the accelerator in the closed position and a brake interlock shall engage a portion of the rear axle service brake system when the rear door control is activated. The braking effort shall be adjustable with hand tools only, from zero effort to the maximum capability of the rear axle brakes. The adjustment device shall be enclosed in a tamper-proof housing, if located inside the bus. An option will be for the interlock to only work on the rear door. New Flyer's non-adjustable braking effort set to 45 PSI is approved as an equivalent to service brake application.

- 7) **Closing Force:** No more than a 10-pound force shall be imposed on a 1 square-inch area of any passenger struck by a closing rear door. A maximum force of 35 pounds shall be required for a passenger to free himself after having either door close upon him, even if the sensitive edge or safety device on the rear door is inoperative.

- 8) **Actuators:** Each door shall be powered by a single actuator and motor (such as those manufactured by Vapor) which shall be both rebuildable and adjustable in such a manner so that the door opening and closing speeds can be independently adjusted from one second up to three seconds. Door actuators shall be adjustable so that the door opening and closing speeds can be independently adjusted from one second up to three seconds. Actuators and the complex door mechanism shall be concealed from passengers but shall be easily accessible for servicing. All elements of the door and actuator system shall operate without a Class 3 failure for 50,000 miles on the design operating profile.
- 9) **Emergency Operation:** In the event of an emergency, it shall be possible to open the doors manually from inside the coach using a force of no more than 25 pounds after actuating an unlocking device at each door. The unlocking devices shall be clearly marked as an emergency only device and shall require two distinct actions to actuate. The door emergency unlocking device shall be accessible at the door areas. When this emergency device is actuated, the door interlock brake system shall apply to stop the bus.

Locked doors shall require a force of more than 100-pounds to open manually. When the locked doors are manually forced to open, damage shall be limited to the bending of minor door linkage with no resulting damage to the doors, engines, and complex mechanism.

1.10 SERVICE COMPARTMENTS AND ACCESS DOORS

- 1) **Interior:** Access for maintenance and replacement of equipment shall be provided by panels and doors that appear to be an integral part of the interior. Removal of fixtures or equipment unrelated to the repair task to gain access shall be minimized. There will be four rear interior access doors, on rear package shelf, below seat, seat back, and under seat. Access doors shall be installed with spring hinges or gas filled props, as necessary to hold the doors out of the mechanic's way. Retention of all interior access panels, except on the door actuator compartments, shall be with tamper proof screws. Panel fasteners shall be standardized so that only one tool is required to service all special fasteners within the bus. All fasteners that retain access panels will be captive in the cover.

Access doors for the door actuator compartments shall be secured with hand screws or latches and shall prevent entry of mechanism lubricant into the bus interior. All fasteners that retain access panels shall be captive in the cover.

Access openings in the floor will be sealed to prevent entry of fumes, road noise, and water into the coach interior. Flooring material will be flush with the floor and will be edge-bound with stainless steel to prevent the edges from coming loose. Access openings will be non-symmetrical so that the ribs of reinstalled flooring will be properly aligned. Fasteners will be tightened flush with the floor.

- 2) **Exterior:** Conventional or pantograph hinged doors shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking liquid to the windshield washer reservoir and for access to the battery compartment master

switch. Access to these compartments shall be from outside the bus. Access openings shall be sized for easy performance of tasks within the compartment including tool operating space. Access door shall be of rugged construction. They shall close flush with the body surface. All doors shall be hinged at the top or on the forward edge and shall be prevented from coming loose or opening during transit service or in the washing operations. All access doors shall be retained in the open position by counterbalancing with over-center or shock supports. Springs and hinges shall be corrosion-resistant. Latch handles shall be flush with, or recessed behind, the body contour and shall be sized to provide an adequate grip for opening. Large access doors shall hinge up and out of the way or flat against the bus body and shall be easily openable by one person. These doors, when opened, shall not restrict access for servicing other components or systems. Major access doors shall be equipped with locks requiring a nominal 5/16-inch, square end tool to open. The locks shall be standardized so that only one tool is required to open all major access doors on the bus. All exterior access doors have stainless steel hinges.

The battery compartment will prevent accumulation of snow, ice, and debris on top of the batteries and will be vented and self-draining. It will be accessible only from outside the coach. All components within the battery compartment, and the compartment in itself, will be protected from damage or corrosion from the electrolyte. The inside surface of the battery compartment's access door will be electrically insulated, as required, to prevent the battery terminals from shorting on the door if the door is damaged in an accident or if a battery comes loose. If the battery compartment is not by itself then the batteries must have a safety cover. Battery tray and slides will be stainless steel.

Two (2) escape hatch/roof ventilator combinations shall be provided in the roof of the bus approximately over the front and rear axle. When open with the bus in motion, the escape hatch/roof ventilators shall provide fresh air inside the bus. The ventilator shall cover an opening area no less than 425 square inches and shall be capable of being positioned as a scoop with either the leading or trailing edge no less than 4-inches, or with all 4 edges raised simultaneously to a height no less than 3½-inches. A tool shall be provided that will allow the operator to open and close the roof hatches.

New Flyer is approved to delete the requirement of access panel from bottom of the floor to the bottom edge of the seat at rear cross bench. The engine and transmission access doors are located underneath the three rear bench seats and held opened by prop rod. The rear electronic equipment access door is located directly above the rear bench. Also an access door will be provided on the floor.

New Flyer is approved to provide certain access panels such as those on antennas to be retained by standard hardware, which is not captive in the cover- approved.

New Flyer is approved to provide the batteries that are housed within the engine compartment on a slide-out stainless steel tray located curb side, not in a separate compartment.

New Flyer is approved to provide roof hatches that are not ventilators. The hatches are 50% larger than standard roof hatches, and are equipped with safety glass tinted to 65% visible light. A safety cable is not required or provided on these hatches.

1.12 WINDSHIELD WIPERS AND WASHERS

- 1) **Wipers:** The bus shall be equipped with a variable speed (including intermittent) heavy duty windshield wiper for each half of the windshield. They will be electrically operated. No part of the windshield wiper mechanism shall be damaged by manual manipulation of the arms. At 60 mph, no more than 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 motors and mechanisms shall be easily accessible for repairs or service from outside the bus.
- 2) **Washers:** The windshield washer system shall deposit washing fluid on the windshield and when used with the wipers, shall evenly and completely wet the entire wiped area.

The windshield washer system shall have a minimum 2.5-gallon reservoir, located for easy access. Reservoir pumps lines and fittings shall be corrosion-resistant and the reservoir itself shall be translucent for easy determination of fluid level. An exterior access door for filling the tank shall be provided. The windshield washer system will be protected with an antifreeze washer solution to -20⁰ F regardless of season of delivery. The protected solution will be tinted to provide easy visual indication that the washer solution is present.

1.13 LIGHTING, CONTROLS, INSTRUMENTS

- 1) **Exterior Lighting:** All exterior lights, including headlights, shall be LED, except for step lights. All exterior lights shall be sealed to prevent entry and accumulation of moisture or dust, and each lamp shall be replaceable in less than 5 minutes by a 2M mechanic. All exterior lamps will be designed to operate on 12 VDC. Lights mounted on the engine compartment doors shall be protected from the impact shock of door opening and closing. Lamps, lenses and fixtures shall be interchangeable to the extent practical. Lamps at the rear of the bus shall be visible from behind when the engine service doors are opened.

Visible and audible warning shall inform following vehicles or pedestrians of reverse operation. Visible reverse operation warning shall conform to SAE Standard J593. Audible reverse operation warning shall conform to SAE Recommended Practice J994-Type C or D.

Lamps at the front and rear doors shall activate only when the doors open and shall illuminate the street surface to a level that meets or exceeds ADA requirements. The lights are to be positioned below the lower daylight opening of the windows and shall be shielded to protect passengers' eyes from glare. One light shall be located above the rear door for this purpose. The lights may be positioned above or below the lower daylight opening of the windows and will be shielded to protect passengers' eyes from glare. These lighting systems must at a minimum provide a minimum of 3-foot candle of light, 5 foot candle of light three feet from the coach is preferred.

- 2) **Headlights:** Front headlights are to be rectangular LED lights, sealed beam type, four (4) in total and located horizontally. The outboard headlight shall be dual type with low beam and high beam capacity are desired, but single headlamps are also acceptable. The adjacent

or inboard headlight shall be capable of high beam only. High beam, low beam functions shall be controlled by a driver's foot switch, sealed and protected from moisture. Sealed beam units shall be latest type and low beam rating of 320-hour rack life, at 12 volts. Low voltage daytime running lights are required.

Dialight LED low beam outer and GE Halogen High Beam inner lights are approved.

New Flyerø combination of LED for low beam and high intensity halogens for the high beams, and front LED round turn signal lights are approved.

- 3) ***Directional Signals:*** Directional signals shall be 2-inch x 6-inch rectangular 4-inch round, or oval at the front 4-inch diameter and 4-inches in diameter at the rear and shall meet FMVSS standards. All shall be LED. Front lights shall have a sealed amber/reflective lens; rear lights shall have a sealed amber lens. Directional signals shall be controlled by two (2) foot switches on the floor.
- 4) ***Stop, Taillights, and accident prevention system:*** There shall be eight (8) 4-inch diameter round lamp assemblies to give indication of direction, stop/tail and back-up operation. Three (3) lights shall be vertically mounted on each side. The lamps shall be mounted on the corner pillars so that they are visible even when the door is open, to provide warning to oncoming vehicles if the vehicle is disabled along the road and to maximize service access when rear and side closure doors are opened. The top light shall be amber, the middle two red, and the lower clear or white. The rear stop, turning, taillights, and accident prevention lights shall be LED lights.

The coach will be equipped with a rear accident prevention system mounted above the engine compartment door (all LED lights). These lamps will be electrically connected to the rear brake lights. The lights will stay lit whenever the rear brake lights are activated.

The accident prevention lights will be amber and flash when any of the doors of the bus open. There will be four amber lamps centered above the engine door. **Wiring for the accident prevention system as per spec will be provided along with a hole in the bus surface. The DTA will separately purchase and attach these lights.**

THE DESIGN, MOUNTING, AND LOCATION OF THE REAR ACCIDENT PREVENTION LAMPS WILL BE SUBJECT TO THE DTA'S REVIEW AND APPROVAL

- 5) ***Marker Lights:*** Individual roof marker lights shall be provided at each corner of bus, with amber front and red rear lens. Intermediate marker lights with amber lens shall be provided in the rubrail position or normal height (there is no requirement for a rubrail) at center of each side of the bus. LED Required. Dialight is acceptable.
- 6) ***Identification Lights:*** Identification lights (Michigan marker lights, individual type) to be mounted at front and rear center of roof crown panels, front to be circular or rectangular amber lens, rear to have rectangular red lenses. LED Required.
- 7) ***Side Directional Lights:*** Two (2) side directional light with an amber lens, to function with front and rear directional signals, shall be mounted just rearward of the front wheel well on each side of the bus. LED Required. New Flyerø configuration of directional

lights located at forward of the rear wheel well and forward of the street side front wheel well is approved.

- 8) **Hazard Lights:** A circuit shall be provided for the directional signals which, when on, will cause them to function as traffic hazard warning signals. LED Required.
- 9) **License Light:** A two (2) candlepower rear license plate light shall be provided in each license plate well. LED Required. (with options of zero, one, or two based on required holders)
- 10) **Service Area Lighting:** Lights shall be provided in the engine compartment to generally illuminate the area for night emergency repairs or adjustments. The lights shall be controlled by a switch located near the rear start controls in the engine compartment.
- 11) **Passenger Interior Lighting:** An overhead LED lighting system will provide general illumination in the passenger compartment and will be controlled independent of the run switch. The system will provide no less than 15 foot candles of illumination 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 except at the rear cross seat where the illumination may be decreased to seven foot candles. All fixture covers will attach with screws, no snap on covers may be used. The overhead interior lighting system shall be LEDs. Pretoria LED interior lighting with programming capability, and Pretoria Gen4 LED lighting are approved

Floor surface in the aisle will be illuminated at no less than ten foot candles. The floor surface in the vestibule will be illuminated to no less than four foot candles with the front door open and to no less than two foot candles when the front door is closed. ADA standards may again be substituted, the new generation Luminator system is acceptable. LED light fixtures will be located above the side windows at or near the juncture of the bus ceiling and the side wall and may be provided over the rear door. LED lighting will not be installed above the driver's side window and the front door. Lamp fixtures and lenses will be fire resistant and will not drip flaming material onto seats or interior trim if burned. Advertising media located in this area will be illuminated by back or direct lighting, although the interior lighting requirements will be attained without advertising media installed. The fixtures will be sealed to prevent accumulation of dust and insects but will be easily operable on hinges for cleaning and service. The lenses will be retained in a closed position and if threaded fasteners are used, they must be captive in the lens with cross-recessed type heads. Power supplies will be enclosed with fireproof material and will be located at the individual light fixtures. Power supplies will be inaudible with an operating frequency above 18,000 Hz. Interchangeability of LED lamps, lenses, fixtures, and power supplies will be maintained.

The forward left and right hand interior light fixtures will be so designed as to automatically extinguish when the front passenger door is closed. When the front passenger door is opened and the interior lights are on the forward left and right hand, interior light fixture will come on. A toggle switch on the driver's instrument panel will allow the driver the option of keeping the forward interior lights on constantly.

A stepwell lighting system will be illuminated when the master switch is in RUN and

NIGHT/RUN, except the front stepwell lamps which will be extinguished when the doors are closed. The system will provide no less than five foot candles of illumination on the entry and exit step treads with the doors open. These lights will be shielded to protect passengers' eyes from glare. Light fixtures will be totally enclosed, splashproof, designed to provide ease of cleaning as well as lamp and housing removal, and will not be easily removable by passengers. Stepwell lights will be protected from damage caused by passengers kicking lenses or fixtures and will not be a hazard to passengers. Gillig's standard three position light control system is approved.

Lighting (in floor or by the steps) by interior steps shall be LED with a service life of at least five years. Wiring for this system shall be corrosion resistant and protected from moisture.

12) *Driver's Lighting:* The driver's area shall have a light to provide general illumination and it shall illuminate the half of the steering wheel nearest the driver to a level of 5ø candles. This light shall be controlled by a switch that is convenient to the driver.

13) *Driver Control:* All switches and controls necessary for the operation of the bus shall be conveniently located in the driver's area and shall provide for ease of operation. Switches and controls shall be essentially within the hand reach envelope described in SAE Recommended Practice, J287, Driver Hand Control Reach. Controls shall be located so that boarding passengers may not easily tamper with control settings. All switches shall be illuminated for night vision. Rocker switches are acceptable.

Accelerator and brake pedals shall be designed for ankle motion. Foot surfaces of the pedals shall be faced with wear-resistant, non-skid, replaceable material. Pedal travel shall be limited by stops under the pedals. Non-adjustable foot pedals are acceptable. Controls for engine operation shall be closely grouped within the driver's compartment. These controls include separate master run switch and start or button switch. The run switch shall be a four-position switch with the following functions:

ENGINE STOP - All electrical systems off, except power available for the interior lighting, stop lights, turn lights, hazard lights, silent alarm, horn, engine compartment lights and run box, auxiliary heater, fire detection/suppression system, and fare box.

NITE/PARK - All electrical systems off, except those listed in OFF and power to radio and marker lights.

DAY/RUN - All electrical systems and engine on, except the headlights, parking lights, and marker lights.

NITE/RUN - NITE/PARK - All electrical systems and engine on. The door control, kneel control, windshield wiper/washer controls and run switch shall be in the most convenient driver locations. They shall be identifiable by shape, touch, and markings. Doors shall be operated by a single control, conveniently located and operable in a horizontal plane by the driver's left hand. The setting of this control shall be easily determined by position and touch. Turn signal controls

shall be floor-mounted, foot-controlled, waterproof, heavy-duty, momentary contact switches. A master run switch with the following decals and controls: Stop Engine; Day Run; Night Run; Night Park is approved.

All switches and controls shall be marked with easily read identifiers. All panel-mounted switches and controls shall be replaceable, and the wiring at these controls shall be serviceable from the vestibule or the driver's seat. Switches, controls, and instruments shall be dust and water resistant. All required switches and controls are included in Table II.

- 15) **Instrumentation:** The speedometer, air pressure gauge(s), and certain indicator lights shall be located on the front cowl immediately ahead of the steering wheel. The steering wheel or rim shall not obstruct the driver's vision of the instruments when the steering wheel is in the straight-ahead position. Illumination of the instruments shall be simultaneous with the marker lamps. Glare or reflection in the windshield, side window, or front door windows from the instruments, indicators, or other controls shall be minimized; instruments and indicators shall be easily readable in direct sunlight.

Indicator lights immediately in front or in the side console of the driver shall include:

TABLE II

Warning Lights

- É High headlamp beam
- É Right turn
- É Left turn
- É Hazard Warning (may be common with turn signal indicators)
- É Exit door open or unlocked
- É Parking brake applied
- É Service brakes applied (may be common with parking brake indicator)
- É Stop request
- É Wheelchair stop request
- É Backup
- É Daytime running lights (if equipped)
- É High beams

Switches

- É Master run switch
- É Start button or switch
- É Kneel switch
- É Turn signal switch(es)
- É Interior lighting switch
- É Instrument panel lighting intensity control
- É Passenger chime switch
- É Driver's area light switch
- É Hazard warning switch
- É Horn button in steering wheel hub, protected to prevent accumulation of transfer punches in steering wheel hub (no identifier required)
- É Foot-controlled headlight dimmer switch, waterproof

- É Fast-idle switch
- É Master door switch
- É Diagnostic light panel test switch

Controls

- É Accelerator pedal with electric adjusting
- É Brake pedal with electric adjusting
- É Door control
- É Windshield wipers
- É Windshield washers
- É Interior climate control
- É Defroster control
- É Driver's heater control
- É Parking/emergency brake control (actuation of brake, not control, shall be indicated to the driver)
- É Transmission control
- É Transmission Retarder Shutoff (location subject to review at preproduction)
- É Front door dump valve
- É Public address system controls
- É Destination sign controls (easily accessible without opening a compartment)

The instrument panel shall include a speedometer indicating readings in mph and kph. The speedometer shall be a rotating pointer type, with a dial deflection of 220° to 270° and 40 mph near the top of the dial. An integral odometer can be supplied as an option.

The speedometer shall be sized and accurate in accordance with SAE recommended practice J678. The speedometer pickup shall be off the transmission tail shaft. The instrument panel shall also include air brake reservoir pressure gauge(s) with indicators for primary and secondary air tanks. The instrument panel and wiring shall be easily accessible for service from the driver's seat or top of the panel. Wiring shall have sufficient length and be routed to permit service without stretching or chafing the wires.

Fuel gauge on dash shall be available as an option.

An LED screen on the instrument panel to show gauge functions is approved.

A back up signal as part of the shift selector unit is approved.

A speedometer with an odometer or an electronic speedometer is also approved.

- 16) **Onboard Diagnostics:** Critical systems or components shall be monitored with a built-in diagnostic system. This diagnostic system shall have visual and audible indicators. The diagnostic indicator lamp panel shall be located in clear sight of the driver but need not be immediately in front of him. The intensity of indicator lamps shall permit easy determination of on/off status in bright sunlight but shall not cause a distraction or visibility problem at night. All indicators shall have a method of momentarily testing the operation of the lamp. Wherever possible, sensors shall be of the closed-circuit type, so that failure of the circuit and/or sensor shall activate the malfunction indicator. An audible alarm shall sound when certain malfunctions are detected by the diagnostic system. The audible alarm shall be 80 to 83 dBA at the ear of a 5th to 95th percentile driver. Malfunction and other indicators listed in Table III shall be supplied on all buses.

Space shall be provided on the panel for future additions of not less than 3 indicators as the capability of on-board diagnostic systems improves.

Table III - Onboard Diagnostic Indicators

Visible Indicator	Audible Alarm	Function
Low oil*	Yes	Engine oil pressure low
Hot engine*	Yes	Engine coolant temperature high
Low air	Yes	Air system pressure low in primary or secondary reservoirs
Low coolant*	Yes	Radiator water level low
Generator stop	Yes or No	Generator not charging
Kneel activated	Yes	Kneeling system activated
A/C stop	No	Compressor off at high/low switch.
Fire	Yes	Over temperature in engine compartment.
ABS Fail	No	Failure of antilock braking
Check Engine	No	Engine code sent
Check Transmission	No	Transmission code sent
W/C Ramp	Yes	Ramp deployed

*Visual indicators may be common; however, both functions shall be provided.

1.14 INTERIOR TRIM

- 1) **General Requirements:** The interior shall be generally pleasing - simple, modern, and free from superficial design motifs. It shall have no sharp depressions or inaccessible areas and shall be easy to clean and maintain. To the extent practical, all interior surfaces more than 10 inches below the lower edge of the side windows, or windshield shall be shaped so that objects placed on them fall to the floor when the bus is parked on a level surface. Handholds, lights, air vents, armrests, and other interior fittings shall appear to be integral with the bus interior. There shall be no sharp, abrasive edges and surfaces and no unnecessary hazardous protuberances. All plastic and synthetic materials used inside the bus shall be fire-resistant, except vinyl seat coverings which shall meet the requirements of Federal Specification CCC-A-680a Class 2(a)1 and seating upholstery textiles which shall meet the requirements for textiles in Federal Aviation Regulations Section 25.853(b), as tested in accordance with Appendix F of that part.

Materials shall be selected on the basis of maintenance, durability, appearance, safety, flameproof, and textile qualities. Trim and attachment details shall be kept simple and unobtrusive. Materials shall be strong enough to resist every day and vandalism; they shall be resistant to scratches and markings. Interior trim shall be secured to avoid resonant vibrations under normal operational conditions. Melamine, thermoplastics, kydex, polyethylene plastics, and transmagic GRP are all acceptable materials to be used in this area. Final color and patterns will be chosen by the DTA after the award.

- 2) **Trim Panels:** Side wall panels below the windows are to be constructed of 1/10-inch standard color melamine, retained by anodized aluminium moldings. Adhesive cushion strips are applied to frame before panels are applied.

The side window post cap mullions are to be constructed of 1/10-inch Antique White gloss material. Painted material is not acceptable.

- 3) **Headlining:** Ceiling trim panels shall be melamine, or equal, 1/8-inch minimum thickness, Antique White in color. Headlining shall be supported to prevent buckling, drumming, or flexing and shall be secured without loose edges. Adhesive cushion strips are applied to frame before panels are applied. Headlining materials shall be treated or insulated to prevent marks due to condensation where panels are in contact with metal members. Moldings and trip strips, as required to make the edges tamper proof, shall be stainless steel snap track. The outer edges of the panels are retained at the top of the side air duct/lighting fixture housing. Headlining panels covering operational equipment that is mounted above the ceiling shall be on hinges for ease of service but retained to prevent inadvertent opening. Ceiling insulation shall have an R value greater than or equal to 5 and with low water absorption and meet all Federal requirements. Polystyrene EPS is an acceptable material.
- 4) **Front End:** The entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent the driver from kicking or fouling wiring and other equipment with his feet. The front end shall be free of protrusions that are hazardous to passengers standing or walking in the front of the bus during rapid deceleration. Panelling across the front and any trim around the driver's compartment shall be formed metal, plastic or fiberglass material. Formed metal dash panels shall be painted and finished to exterior quality. Plastic dash panels shall be reinforced, as necessary, vandal-resistant, and replaceable. All colored, painted, and plated parts forward from the driver's barrier shall be finished with a dull matte black finished surface, driver's platform is elevated at least 7½-inches above the floor level. A proper platform and wiring for the DTA installed farebox must be in place; a 6-inch to 9-inch pedestal is needed.
- 5) **Rear End:** The interior rear wall shall be carpeted and the riser below the rear seat will be ½-inch plywood covered with matching rubber transit flooring. The rear bulkhead will be panelled with reinforced moulded fiberglass (gelcoated Antique White). The ledge between the rear lounge seat and the engine compartment will then be covered with carpet to dampen the sound. Access to rear electrical console is provided via a hinged panel.
- 6) **Passenger Information and Advertising:** Advertising media 11-inches high and 0.09-inch thick shall be retained near the juncture of the ceiling and side wall. The retainers may be concave and shall support the media without adhesives. The media shall be illuminated by the interior fluorescent lighting system.

1.15 PASSENGER SEATS

- 1) **Arrangements:** Seating and interior trim shall have features to improve safety, comfort, and capacity. The passenger seats shall be arranged in a transverse, forward facing configuration, except over the rear wheelhousings, wheelchair areas and fuel storage bay where seats may be

arranged as appropriate with due regard for passenger access and comfort. As many seats as possible shall be forward facing and none shall be rear-facing. Seating capacity shall be 38 passengers or greater, including two wheelchair positions. Hip-to-knee room at all seating positions shall be no less than 26 inches using a fiberglass molded shell seat. Foot room, measured at the floor forward from a point vertically below the front of the seat cushion, shall be no less than 12 inches. Seats immediately behind the wheelhouses may have foot reduced, provided the wheelhouse is shaped so that it may be used as a footrest. Please provide a seating layout with pre-bid materials. Seating layouts to be submitted with pre-bid materials. Hip-to-knee for cushioned seating option shall be minimum 26.5 inches at all seating positions in paired transverse seats immediately behind other paired transverse seating positions.

Each transverse, forward facing seat, except the rear seats, shall accommodate two passengers. Thickness of the transverse seat backs shall be minimized to increase passenger knee room. The area between the longitudinal seat backs and the attachment to the side walls shall be designed to prevent debris accumulation.

The aisle between the seats shall be no less than 24 inches wide at seated passenger hip height and 20 inches at standing passenger hip height. Minimum width of transverse seats shall be 34-inches. Final seating arrangements will be designed by the successful bidder.

- 2) ***Structure and Design:*** The passenger seat and its supporting structure shall be cantilevered between entrance and exit doors and constructed and mounted so that space under the seat is maximized to increase wheelchair maneuvering room and is completely free of obstructions to facilitate cleaning. The structure shall be fully cantilevered from the side wall with sufficient strength for the intended service. The lowest part of the seat assembly that is within 12 inches of the aisle shall be at least 10 inches above the floor. The underside of the seat and the side wall shall be configured to prevent debris accumulation and the transition from the seat underside to the side wall to the floor cover radius shall be smooth. Structural failure of any part of the seat or side wall shall not introduce a laceration hazard. Pedestal seating shall be installed in the raised rear section. Cantilevered and T-Pedestal may also be used in combination. Full pedestal **are not** accepted.

The back of each transverse seat shall incorporate a handhold no less than 7/8-inch in diameter for standees and seat access/egress. The handhold shall not be a safety hazard during severe decelerations. The handhold shall extend above the seat back near the aisle so that standees shall have a convenient vertical assist, no less than 4 inches long that may be grasped with the full hand. This handhold shall not cause a standee using this assist to interfere with a seated 50th-percentile male passenger. The handhold shall also be useable by a 5th-percentile female, as well as by larger passengers, to assist with seat access/egress for either transverse seating position. The seat back handhold may be deleted from seats that do not have another transverse seat directly behind and where vertical assist is provided in accordance with Section 1.22. The handhold shall extend above the seat back near the aisle.

The handhold shall be thermoplastic. Armrests shall not be included in the design of transverse seats.

Longitudinal seats shall be the same general design as transverse seats but without seat back handholds. Longitudinal seats may be mounted on the wheelhouses. When folded up, will make way for one wheelchair per unit of three each longitudinal seats. Armrests shall be included on

the ends of each set of longitudinal seats except on the forward end of a seat set that is immediately to the rear of a transverse seat, the driver's barrier or a modesty panel and these fixtures perform the function of restraining passengers from sliding forward off the seat. Armrests are not required on longitudinal seats located in the wheelchair parking area that fold up when the armrest on the adjacent fixed longitudinal seat is within 1½-inches to 3½-inches of the end of the seat cushion. Armrests shall be located from 7-9 inches above the seat cushion surface.

The area between the armrest and the seat cushion shall be closed by a barrier or panel and still be constructed and trimmed to complement the modesty panels. The top and sides of the armrests shall have a minimum width of 2 inches and shall be free from sharp protrusions that form a safety hazard.

- 3) **Construction and Materials:** Seat material of the standard configuration seat shall be moulded fiberglass. Any visually exposed metal of the standard seat structure including mounting brackets and other components shall be stainless steel. The seat shall be contoured for individuality, lateral support, and maximum comfort and shall fit the framework to reduce exposed edges. The seat back thickness shall not exceed 1/4-inches in the knee room area. Complete seat assemblies shall be interchangeable to the extent practical. The shell shall be recessed in seat and back areas to accept padded or fiberglass inserts.

Materials used shall minimize damage from vandalism and shall reduce cleaning time. The seat shall be contoured for lateral support, individuality, and comfort to each individual passenger, and constructed of energy absorbing materials. The upper rear portion of the seat back, seat back handhold, and upper rear surface of the modesty panels located immediately forward of transverse seats shall be constructed of energy absorbing materials. All passenger seats will be either Transportation Seating (TSI) Model 1111 ADB (Cantilevered Design), American Seating InSight with the vandal resistant fabric seat inserts, or an approved equal. **COLORS WILL BE CHOSEN AFTER THE BID AWARD WITH STANDARD COLORS APPROXIMATING THOSE PREVIOUSLY SPECIFIED.**

The minimum radius of any part of the seat back, handhold, or modesty panel in the head or chest impact zone shall be a nominal 1/4-inch. Color of the padding shall complement the balance of the interior and shall be consistent throughout the material. Seats, back cushions, and other pads shall be securely attached and shall be detachable by means of a simple release mechanism employing a special tool so that they are easily removed by the maintenance staff but not by the passengers. All seat cushions and backs shall be interchangeable throughout. All materials and workmanship shall conform to SPI standards and specifications in tests for plastic foam. Materials shall have high resistance to tearing, flexing, wetting and shall comply with safety standards of White Book Docket 90A.

- 4) **Wheelchair Position:** The American seating system with telescoping arm and retractable belts shall be used. Colors of these seats and inserts or cushions shall match regular seats. Flip-up seat (sets of two or three), shall be installed to accommodate parking space and secure tiedown for passengers in wheelchairs. These seat assemblies shall have the capabilities of folding up to make way for two wheelchairs. The tie-down positions shall be on either side of the bus, not both on the same side. Maneuvering room inside the bus shall accommodate easy travel for two passengers in wheelchairs from the loading device through the bus to the designated parking area and back out. Maneuvering must meet ADA standards.

Engineering diagrams should be included to confirm this. No portion of the wheelchair or its occupant shall protrude into the normal aisle of the bus when parked in the designated parking space. As a guide no width dimension should be less than 34 inches, areas requiring 90° turns of wheelchairs should have a clearance arc dimension no less than 45 inches and in the parking area where 180° turns are expected, space should be clear in a full 48-inch diameter circle. A vertical clearance of 12 inches above the floor surface should be provided on the outside of turning areas for wheelchair footrest clearance.

The ramp shall be a 6 to 1 ratio with Stainless steel close-out, Lift-U LU 18 or approved equal.

Lights shall be provided above the doorway or adjacent to the stepwell equipped with the wheelchair ramp to floodlight the loading area. The lamps shall illuminate when the ramp is in operation and shall illuminate the street surface as per previous specification. This seat assembly shall be equipped with fold-down seats for use when no wheelchair is parked. Wheelchair position, chair restraints and passenger tiedown shall meet all ADA laws and Federal safety requirements.

1.16 DRIVERS SEAT

Drivers Seat: The driver's seat shall be an air suspension type with headrest, pneumatic side bolsters in the seat back for lateral support and pneumatic lumbar support in the lower part of the seat back cushion. The driver's seat will be an air ride Recaro Ergo Metro with air bolster adjustment, manual lumbar support, and vent, Highback Vinyl Black Leather with cloth insert required (HBCLVBLK) or approved equal. The seat must be equipped with a retractable seat belt that does not interfere with the movement and adjustability of the seat. Upholstery will be ventilated. The driver's seat shall be ergonomically designed so it will adjust to compensate for different driver sizes. All controls must be conveniently accessible by the operator from the seated positions. The driver must be able to operate the manual back recline and seat cushion tilt controls from both sides of the seat. A complete instruction sheet on the operation of the driver's seat shall be installed on the back of the front sun visor or on driver's effects door.

Seat support shall have sufficient dampening capability to preclude "bouncing" while travelling upon rough roadway surfaces. Fore and aft seat travel must be at least nine (9) inches, adjustment accomplished by an air actuated fore and aft slide release. Seat stops shall be supplied to prevent the seat hitting the driver's barrier. An ABS plastic protective backshell shall be installed onto the seat back to protect the upholstery. Seat back frame shall be constructed of tubular steel and shall be equipped with a solid steel back that prevents breakthrough. The back pan shall be curved to support the cervical, thoracic, lumbar, and sacral regions of the back.

Seat belts shall be retractable, mounted to the seat with an internal safety strap that allows the seat to meet the FMVSS 207/210 pull test. Seat belt release shall be on the left-hand side of the driver. **The seat and shoulder belt shall be orange in color.** Vertical adjustment travel of the seat must not be more than five (5) inches. The seat shall accommodate drivers from the 5th percentile female to the 95th percentile male.

1.17 FLOOR COVERING

In addition to the specifications below the DTA will accept Altro Transflor and Tarabus Galaxy NT transit flooring in standard colors to be determined for the flooring material. RCA Rubber shall be available at procuring agency's option.

- 1) **Vestibule:** The floor in the vestibule shall be covered with 3/16 of an inch, non-skid, rubber composition material that remains effective in all weather conditions. Altro Trans Flor is recommended. The floor covering, as well as transitions of flooring material to the main floor and to the stepwell area, shall be smooth and present no tripping hazards. Floor covering ribs shall run transversely in line with the entrance, longitudinally in line with the aisle. The floor rubber shall; be grey in color. The standee line shall be at least 2-inches wide and shall extend across the coach aisle in line with the driver's barrier. This line shall be the same color as the edge of the steps, bright yellow. DTA requests Altro or approved equal. Floor coverings running from front entrance door to driver's platform and aisle floor coverings running up to the standee line are approved.
- 2) **Driver's Compartment:** The floor in the driver's compartment shall be easily cleaned and shall be arranged to prevent debris accumulation. Any floor coverings shall be 3/16 of an inch thick, smooth surface, heavy-duty, rubber composition material. Color of the driver's floor shall be coordinated with the vestibule.
- 3) **Passenger Area:** The floor in the passenger area shall be covered with non-skid rubber composition material that remains effective in all weather conditions. A one-piece center strip shall extend from the rear seat between the aisle sides of transverse seats to the standee line. The covering between the center strip and the wheel housings may be separate pieces. The material shall be 3/16 of an inch thick in the aisle section and longitudinally-ribbed strip as wide as the door shall extend from the center strip to the top step.

At the rear door, however, a separate transversely-ribbed strip as wide as the door will extend from the center strip to the top step.

The floor under the seats shall be covered with 1/8 of an inch thick, smooth surface flooring material. The floor covering shall closely fit the sidewall cover or extend to the top of the cover. Color of the floor covering in the passenger compartment shall be the same as that in the vestibule.

The floor covering will be attached continuously to the subfloor by waterproof adhesives without voids. All seams and interfaces with the wall, wheel wells, etc., will be covered with trim or butt joints that will provide a floor that is free of tripping hazards and easy to clean by dry and wet wash with cleaning solutions. Clear or matching silicone caulking, H.D. Fuller Adhesive, or Sikaflex 221 will be used at any point such as seams where moisture may enter into the flooring material. Caulking will not be required if the plywood used is marine grade and the adhesive used is St. Claire #45136. Other approved adhesives include Aquastik 2900 and Scotch-Grip 847. A separate strip at the rear door extending to the outboard edge of the rear/exit area to the edge of the fuel tank enclosure is approved. In areas where the Altro flooring cannot be welded, color-matching sealant must be applied.

- 1) **Windshield:** The windshields are laminated, formed safety glass ASI, .270-inch-thick laced in a reinforced fiberglass aperture or 1/4 -inch tinted safety or laminated glass is acceptable. The windshield shall permit a driver's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of 15° measured above the horizontal and including any shaded band. The vertically downward view shall permit detection of an object 3½ feet high no more than 2 feet in front of the bus. The horizontal view shall be a minimum of 90° above the line of sight. Any binocular obstruction due to a center divider may be ignored when determining the 90° requirement provided that the divider does not exceed a 3° angle in the driver's field of view. Windshield pillars shall not exceed 10° of binocular obstruction.

The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus. When the bus is operated at night with the passenger interior lighting on, essentially no reflections shall be visible in the windshield immediately forward of the driver's barrier. Reflections in the remainder of the windshield shall be minimized, and no reflection of any part of the bus interior behind the driver's barrier shall be visible in the windshield. The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshield shall not be used. The glazing material shall have single density tint. The upper portion of the windshield above the driver's field of view shall have a dark, shaded band with a minimum luminous transmittance of 6% when tested in accordance to ASTM D-1003. Windshield, driver's window and side windows must not fog at the edges during their useful life. The useful life of this glass is six (6) years.

- 2) **Driver's Window:** The driver's window shall be sliding and open sufficiently to permit the seated driver to easily adjust the left outside rear-view mirror. This window section shall slide rearward in tracks or channels. The driver's side window shall not be bonded in place and shall be easily replaceable. The glazing material shall be a 1/4-inch or 7/32-inch single density tint, laminated safety glass. Window tint shall be green and a minimum of 23% light transmittance or match the windshield.
- 3) **Side Windows:** Side windows shall extend from the shoulder height of 5th-percentile, seated, female passenger to the eye level of a 95th-percentile, standing male passenger. Vertical mullions between windows including the trim shall not exceed 10 inches in width. All side windows shall be fixed windows and shall comply with FMVSS-217. The windows will be non-openable by the customer except in an emergency. They shall be easily replaceable without disturbing adjacent windows. The frames shall be black anodized aluminium. Windows are fitted with emergency latches as per FMVSS-211 in the lower portion of the coach.

Options shall be provided for top tip-in transom, flush mount fixed windows, and flush mount top tip-in windows. Exception to top tip-in shall be allowed for narrower window panels. Up to 4 windows may be required to have paint applied to a portion of the glazing (Dura Ceramic Ink Jet Printing or equivalent process).

Side window glazing material shall be 1/4-inch nominal thickness laminate glass or approved equal. The material shall conform with the requirements of ANSI Z26.1-1977 Standard for Type AS-5 Safety Glazing Materials except for Test Number 17 which shall subject the

specimens to 1000 cycles and the arithmetic mean of the percentages of light scattered shall not exceed 5%. Windows on the sides and in the rear door shall be tinted a neutral color, complementary to the exterior. The maximum solar energy transmittance shall not exceed 44%, as measured by ASTM E-424, and the luminous transmittance shall be no less than 16% as measured by ASTM D-1003. The destination sign glass shall be clear. Side window sashes will be made of black anodized aluminium.

Option shall be available for 28% solar energy transmittance. New Flyer is approved to provide the side windows glazing material with ANSI standard type AS-3. AS-2 type glazing material is too dark for this application.

- 4) **Rear Window:** No rear window will be required unless required by the bidder. If it is it will be a fixed, one-piece ¼-inch single density laminated glass clamped to rear panel or ɔzipped inö.

1.19 INSULATION

- 1) **Properties:** Any insulation material used between the inner and outer panels shall be fire-resistant and sealed to minimize entry of moisture and to prevent its retention in sufficient quantities to impair insulation properties. Insulation properties shall be unimpaired by vibration compacting or settling during the life of the bus. The insulation material shall be non-hygroscopic and resistant to fungus and breeding of insects. Any insulation material used inside the engine compartment shall be fire-resistant and shall not absorb or retain oils or water. Gilligø standard insulation systems is approved.
- 2) **Thermal Insulation:** The combination of inner and outer panels on the sides, roof, and ends of the bus, and any material used between these panels shall provide a thermal insulation to meet the interior temperature requirements. The body shall be adequately sealed so that drafts cannot be felt by the driver or passengers during normal operations with the passenger doors closed. Styrofoam SM brand thermal insulation is used between panels. New Flyer is approved to provide 1-inch polystyrene foam insulation manufactured by an extrusion process on the roof and side wall panels with R-value of 5.0. The product must comply with burn rate criteria of FMVSS 302.
- 3) **Sound Insulation:** The combination of inner and outer panels and any materials used between them shall provide sufficient sound insulation so that a sound source with a level of 80 Dba measured at the outside skin of the bus shall have a sound level of 65 Dba or less at any point inside. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and accessories switched off.

The bus-generated noise level experienced by a passenger in any seat location in the bus shall not exceed 83 Dba and the driver shall not experience a noise level of more than 75 Dba under the following test conditions.

The bus shall be empty, except for test personnel, not to exceed four persons, and the test equipment. All openings shall be closed and all accessories shall be operating during the test. The bus shall accelerate at full throttle from a standstill to 35 mph on level commercial asphalt or concrete pavement in an area free of large reflecting surfaces within 50 feet of the path. During the test, the ambient noise level in the test area shall be at least 10 dB lower than the bus under test. Instrumentation and other general requirements shall conform to SAE Standard J366. If the noise contains an audible discrete frequency, a penalty of 5 Dba shall be added to the sound level

measured.

1.20 ANCILLARY FEATURES

1) ***Visors:*** Adjustable sun visor(s) will be provided for the driver's side of the windshield and the driver's side window. Visor(s) will be shaped to minimize light leakage between the visor and windshield pillars, there must not be a gap of greater than 1 inch. Pull down visors are requested. **If one visor will not cover sufficiently then two are required.** Visors will store out of the way and will not obstruct air flow from the climate control system or foul other equipment such as the radio handset or the destination control. Deployment of the visors will not restrict vision of the rearview mirrors. Visor adjustments will be made easily by hand. Sun visor construction and materials will be strong enough to resist breakage during adjustments. Visors, when deployed, will be effective in the driver's field of view at angles more than five degrees above the horizontal. The sun visor for the operator's window shall be the roller shade type of visor. In addition to visors, a coat hook and strap shall be installed in the driver's area.

2) ***Exit Signal:***

General: A passenger chime signal audible to the driver and to passengers anywhere inside the coach will be provided. The chime will have pull cords that are convenient to seated passengers, standees, and passengers standing at the rear door. Standees will be able to easily reach the chime signal located near the passenger interior lighting fixtures. Separate controls shall be provided at each wheelchair securement location which shall be no more than 48 inches nor less than 15 inches above the floor these will be tape switch or touch pad at purchasing agency's option. It shall be operable by one hand and shall not require tight grasping, pinching, or twisting of the wrist. Force required shall not exceed 5-foot pounds. A driver-controlled toggle switch will deactivate the chime system. A stop request feature is to be incorporated into the exit signal system, this will feature an electric sign in the front center of the bus noting a stop has been requested and a colored light on the operator dash plainly visible to the driver. A separate light signal is required for wheelchair patrons. The DTA will approve a system that meets ADA requirements. Such a system is made by Transsign and the ADA light is on the end of the stop requested sign. The DTA also requires a light on the dash. A "Stop Request" sign located behind the driver built into the Secure Diagnostic Station (SDS box) is approved. A stop request indicator light on the driver's instrument panel is required.

3) ***Outside Mirrors:*** The base bid shall include remote control and heated mirrors. The coach will be equipped with remote controlled, corrosion resistant, outside rearview mirror on each side of the coach. The mirrors will permit the driver to view the highway along both sides of the bus including the rear wheels. Each rear-view mirror will measure at least ten inches (height) by eight inches (width) and have a minimum surface area of 80 square inches. Additionally, a 5-inch diameter convex mirror will be mounted to the rectangular mirror, it will be above the rectangular mirror on both sides of the bus. Additionally, a 4-inch by 6-inch convex mirror will be mounted to the rectangular mirror on the passenger side of the bus. Mirrors will be firmly attached to the coach to prevent vibration and loss of adjustment, but not so firmly attached that the coach or its structure is damaged when the mirror is struck in an accident. Mirrors will be mounted so that its lower edge is no less than 80 inches above the street surface. Mirrors will retract or fold sufficiently to allow automatic washing operations. New Flyer is approved to provide a curbside mirror without 5-inch diameter round mirror on top of the primary mirror as primary mirror arm

would cause visual interference. The primary mirror 10-inch x 11-inch flat mirror will be provided with a 5-inch x 7-inch convex mirror mounted below the primary mirror. New Flyer is approved to provide the right side rearview mirror mounted so that its lower edge is no less than 76 inches above the street surface.

- 4) **Inside Mirrors:** Mirrors shall be provided for the driver to observe passengers throughout the bus without leaving his seat and with shoulder movement, with a full standee-load, (including standees in the vestibule) he shall be able to observe passengers in the front and rear stepwells, anywhere in the aisle, and in the rear seats. Inside mirrors shall not be in the line of sight to the right outside mirror.

A center rear view mirror will be located above the windshield. A right windshield header mirror, 6-inch round, will be located so as not to interfere with passenger traffic and be mounted on an adjustable bracket. A 12-inch parabolic mirror will be mounted at the exit door area to an adjustable bracket and allow the operator to view the exit door and stepwell area.

5) **Safety Equipment:**

- a) 5 lb Fire extinguisher (ABC type). The safety equipment shall be mounted where it is easily accessible to the Driver.
 - b) Safety Triangles - three bi-directional emergency reflective triangles conforming to the FMVSS 125 in a case and mounted.
 - c) First Aid Kit - one First Aid Kit meeting or exceeding the requirements of Manufacturers Code 81.16. It shall contain at a minimum - 2 units of 1-inch adhesive tape at least 7.5 feet long - 2 units of sterile gauze pads that are 3-inch by 3-inch and a minimum of 12 per unit - one box of 100 bandages that are 3/4 inch by 3-inch disposable CPR mouth piece. In addition, a standard Body Fluid Clean-Up Kit shall be provided. This is the minimum requirement.
 - d) Biohazard Kit
 - e) Seat Belt Cutter.
- 6) **Driver's Security Box:** A security box shall be provided in the general driver's area to allow the driver to secure his valuables. The box cover shall be retained with a 1/4 turn thumb latch.
- 7) **Hubodometer:** A hubodometer on the right rear wheel with a guard is required.

1.21 PASSENGER ASSISTS

- 1) **General Requirements:** Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape, and size for both the 95th-percentile male and the 4th-percentile female standee. They will all be covered with **yellow powder** coat. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of seat back assist or as a separate item so that a 5th-percentile female passenger may easily move from one assist to another using one hand and the other without losing support. Excluding those mounted on the seats and doors, the assists

shall be 1 1/4-inch in diameter or width with radii no less than 1/4-inch. All passenger assists shall permit a full hand grip with no less than 1 1/2-inch of knuckle clearance around the assist. One hanging strap is required between each vertical pole with a minimum of ten per bus. To clarify all vertical assists shall be covered with yellow powder coat and all horizontal assists shall be brushed stainless steel.

A crash resulting in a 1-foot intrusion shall not produce sharp edges, loose rails, or other potentially dangerous conditions associated with a lack of structural integrity of the assist. All joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. All areas of the passenger assists that are handled by passengers including functional components used as passenger assists, shall be 16-gauge stainless steel with 180 grid finish. Assists shall withstand a force of 300 pounds applied over a 12-inch lineal dimension in any direction normal to the assist without permanent visible deformation. Brackets, clamps, screw heads, and other fasteners used on the passenger assists shall be free of rough edges.

- 2) **Vestibule:** The aisle side of the driver's barrier and the modesty panels shall be fitted with vertical passenger assists. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm. A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries of the fare collection device or windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure.

Passengers shall be able to lean against the assist for security while paying fares. The assist shall be no less than 36-inches above the floor or the average step tread surface. The assists at the front shall be arranged to permit a 5th percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the driver's barrier or front modesty panel.

- 3) **Overhead:** Except forward of the standee line and at the rear door, a continuous, full-grip overhead assist shall be provided. This assist shall be convenient to standees anywhere in the bus and shall be located over the center of the aisle seating position of the transverse seats. The assist shall be no less than 70 inches above the floor. Overhead assists shall simultaneously support 150 pounds on any 12-inch length. No more than 5% percent of the full grip feature shall be lost due to assist supports. In the area over the wheelchair position a plastic assist will hang from the overhead assist.

Two grabstraps per section (defined by vertical assists) shall be provided.

- 4) **Longitudinal Seats:** Longitudinal seats, excluding flip up seats, shall have vertical assists located between every other designated seating position. Assists shall extend from near the leading edge of the seat and shall be functionally continuous with the overhead assist. Assists shall be staggered across the aisle from each other where practical and shall be no more than 52-inches apart.
- 5) **Rear Doorway:** Vertical assists that are functionally continuous with the overhead assist shall be provided at the aisle side of the transverse seat immediately forward of the rear door and on the aisle side of the rear door modesty panel. Rear doors, or the exit area, shall be fitted with assists no less than 3/4-inch in width and shall provide at least 1 1/2 inch of knuckle clearance

between the assists that are functionally continuous during the entire exiting process, and the assists shall be no more than 6 inches from the outside edge of the lower step tread.

1.23 WHEELCHAIR RAMP, SECUREMENTS

- 1) **Ramp:** A fold out electrical (hydraulic backup) operated ramp (ADA compliant) with stainless steel tray shall be provided at the front door for deployment by the driver from the drivers seated position. The deployed ramp measuring 30.5 inches wide or wider and 44-inches long or longer shall fold out to the curb height and retract back into a recessed floor area. The recessed area shall be designed to prevent passengers from tripping or falling while entering and exiting the bus.

The driver's controls consist of an easy to operate three-position toggle switch on the instrument panel marked DEPLOY-STOW or DEPLOY - FLOAT - STOW. The ramp will be the flip out not cassette style of ramp. The ramp must be able to be manually deployed by a pull strap. It shall also be sealed so that dirt and debris will not enter the mechanism.

Approved ramp for the DTA is Lift-U LU18 Dual Mode or approved equal.

New Flyer's flip type ramp made of 3/16-aluminum, with a clear width of 32.25 inches, a length of 47.6 inches, rated at 600 lbs. with a deployment angle ratio of 1:6, is approved provided it meets all ADA requirements.

- 2) **Securement:** For each wheelchair position the wheelchair restraint devices shall be Q-Pod by Q Straint or approved equal. Wheelchair accessible buses will have two forward facing tie downs (approved by the Minnesota Department of Transportation) and jump seats. **An extra seat belt extension that is 24 inches in length will be provided with each bus. Prior to release of vehicle for delivery, Contractor shall supply for review by procuring agency a copy of the wheelchair securement manufacturer's certificate of approval from the State of Minnesota, Department of Public Safety, pursuant to Minnesota Rules 7450.0500.**

Passenger securement devices must have permanent part numbers affixed to each retractor as per MN DOT requirements.

The exit signal shall be easy to reach. All systems must meet current ADA rules and regulations.

1.24 Propulsion System

- 1) **Power Requirements:** Propulsion system and drive train shall provide power to enable the bus to meet the defined acceleration, top speed, and gradability requirements. Enough excess power shall be available to operate all accessories.
- 2) **Top Speed:** The bus shall be capable of a top speed of 60 mph (for emergency and passing maneuvers) on a straight, level road at SLW with all accessories operating. Option shall be available for top speed of 68 mph governed to 65 mph.

- 3) **Gradability:** Gradability requirements shall be met on grades with a surface friction coefficient of 0.3 and above at SLW with all accessories operating. The standard configuration powerplant shall enable the bus to maintain a speed of 38 mph on a 5% grade and 22 mph on a 10% grade or 40 mph on a 4.47% grade and 22 mph on an 8.25% grade. Gradability is more important than top speed. Final gear ratios will be discussed with successful bidder.
- 4) **Acceleration:** An average acceleration rate of at least 0.6g shall be achieved at SLW between 0 and 15 mph. Acceleration measurement shall commence when the accelerator is depressed.
- 5) **Jerk:** Jerk, the rate of change of acceleration, shall be minimized throughout the acceleration/deceleration range and shall average 0.3g/sec under normal driving conditions.
- 6) **Operating Range:** The operating range of the bus run on the design operating profile shall be at least 300 miles on a fill-up of fuel in the Duluth\Superior area.

1.25 PowerPlant Mounting and Accessories

- 1) **Mounting:** The powerplant shall be mounted in a compartment in the rear of the coach. The engine, transmission, and radiator shall be mounted in a cradle assembly which can be easily removed using a standard industrial forklift or frame mounted with easy access to these components. If needed, guide pins or self-centering slides shall be incorporated so that the installation can be easily accomplished by one person. All powerplant mounting will be mechanically isolated by means of rubber mounts to minimize transfer of vibration to the body structure. The powerplant shall be mounted in a compartment in the rear of the bus. All powerplant mounting shall be mechanically isolated to minimize transfer of vibration to the body structure. Radiator may be roof mounted.
- 2) **Service:** 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 3M 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 be easily removable and independent of the engine and transmission removal. An engine oil pressure gauge, coolant temperature gauge, engine control switch, starter controls switch and lamp switch shall be provided in the engine compartment. The gauges shall be easily read during service and mounted in an area where they shall not be damaged during minor or major repairs.

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

The engine and transmission shall be equipped with enough heavy-duty fuel and oil filters for efficient operation and to protect the engine and transmission between scheduled filter changes. The engine oil filter shall be OEM. All filters shall be easily accessible and the

filter bases shall be plumbed to assure correct re-installation. There will be shut off valves on either side of **all** removable filters so as to prevent loss of fluids when changing the filter. Where filters are mounted directly to the engine block or are the internal cartridge type for the transmission the shut off valves are not required. Fuel and oil lines within the engine compartment shall be rigidly supported and shall be composed of steel tubing where practical except in locations where flexible lines are specifically required. Flexible fluid lines shall be kept at a minimum and shall be as short as practical. They shall be routed or shielded so that failure of a line shall not allow fuel or oil to spray or drain onto any component operable above the auto-ignition temperature of the fluid. Flexible lines shall be FC300, FC355, GH195, or FC510/2807 PTFE, in applications where premium hoses are required, such as the Power Steering output line, and shall have standard SAE or JIC brass or steel, reusable, swivel, end fittings. Hoses shall be individually supported and shall not touch one another or any part of the bus. A fuel priming pump or a check valve fitted in the fuel suction line to aid restarting after fuel filter changes. Flexible hoses may be used but must meet all Federal safety regulations. The fuel filter on standard diesel buses shall be Davco 384 (heated).

- 3) **Accessories:** Engine-driven accessories shall be unit mounted for quick removal and repair. Accessory drive systems shall operate without failure or unscheduled adjustment for 50,000 miles on the design operating profile. These accessories shall be driven at speeds sufficient to assure adequate system performance during extended periods of idle operation and low route speed portion of the design operating profile. Belt guards shall be provided as required for safety and shall be sturdy in design and installation and readily removable.

1.26 Engine

- 1) New Flyer is approved to provide the hybrid system in which the engine is started using the motors in the transmission, not a separate starter motor. The Hybrid system does not have an alternate or auxiliary power supply for starting the engine.
- 2) **Type:** Engine: The engine will be an L9 Cummins (**with updated Insight software**) that meets current fuel requirements. The engine provided must be capable of generating a minimum of 275 brake horsepower at 2100 RPM and 890 foot pounds of torque at 1200 rpm. During the warranty period the local engine dealer will perform all warranty maintenance on the engine.

The engine will also be mounted on rubber type mounts to the vehicle frame and body for isolation of noise and vibration, so as to provide maximum isolation of audible frequencies over the range of 35 to 275 Hertz (cycles per second). The engine shall, with normal maintenance, operate with no smoke or objectionable odor using fuels and oils meeting the manufacturer's recommendation. The engine shall meet all Federal emission regulations applicable.

The engine will operate for 300,000 miles without major failure or significant deterioration. It will have traction control. Traction Control is linked to the brakes ABS. If the Offeror proposes an engine other than specified by the DTA the Offeror must provide the DTA with the following information before their request will be considered.

- a. Full technical specifications of the engine being proposed.

- b. The length of the warranty period and the name of the local service representative that will be handling the engine during the warranty period.
- c. Parts manual and price catalogue showing the cost of engine parts.
- d. Additional training that will be provided to the DTA.
- e. Complete list of transit systems in the United States using the proposed engine in 40-foot transit buses. This list must clearly show the date the buses were placed in service, the present chassis mileage on the buses, contact person, and the telephone number for each system.

The engine will meet all requirements when operating on No. 2 diesel fuel (with a minimum of 5% and a maximum of 20% ethanol) or Ultra Low Sulphur diesel (which requires a stainless-steel particulate trap) including State-mandated biofuel content between 5% and 20%. Durability of the engine and its components will not be seriously reduced and the requirement of Section 3.1.4.1 will be met by operation on either of the commercially available diesel fuels.

The engine will be equipped with a driver-controlled fast idle device. The starter must be shielded from all fluids, such as fuel or oil. The device will activate only with the transmission in neutral and parking brakes applied. This device may be used to help meet the requirements of coach cool down in Section 3.7. The engine starter will be protected by an interlock that prevents its engagement when the engine is running. The starter will be prevented from engaging when the transmission selector is in any position other than neutral.

An air filter restriction indicator will be provided and calibrated to 20 inches of water/vacuum.

All major repairs to the engine during the warranty period will be the responsibility of the Offeror. The Offeror will provide full details on the warranty service center the Offeror is planning to use.

The engine shall be equipped with an automatic engine shut-off circuit, with time delay and overrule switch. The automatic engine shut-off circuit shall be activated by each of the following warning systems:

- low engine coolant,
- engine overheat, and
- low engine oil pressure.

The engine shall operate to the manufacturers recommended design operating profile without major failure or significant deterioration.

An oil extraction fitting shall be attached to the engine's oil pressure gauge.

- 3) **Fast Idle:** The engine shall be equipped with a fast-idle device either driver-controlled or automatically activated with the interior climate control system. If driver-controlled the device shall activate only with the transmission in neutral.
- 4) **Air Intake:** The engine air intake shall be through an opening at the rear top of the bus. The

engine air duct shall be so positioned as to minimize water entrance into the air induction system. 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.

- 5) **Alternator:** Alternator shall be a Niehoff C803D, 525 Amp, governed to 58 mph.
- 6) **Cooling System:** Temperature of operating fluids shall be controlled by a cooling system(s). The cooling system shall be sized to maintain fluids at safe, continuous operating temperatures during the most severe operations possible with the bus loaded to GVWR and with ambient temperatures up to 106°. The engine shall be cooled by a water-based, pressure type, cooling system that does not permit foiling or coolant loss during the operations described above.

The cooling system shall incorporate an engine thermostat and fan by means of a single belt. The temperature settings shall open at 180°F and activate a hot engine warning at 212°F or as determined by the manufacturer. The 180° engine thermostats shall be easily accessible for replacement. The engine cooling system shall be equipped with a properly sized water filter with a spin-on, disposable, borate element filter as required by the manufacturer. Shutoff valves shall allow filter replacement without coolant loss. Valves shall permit complete shutoff of both lines for the heating and defroster units. 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.

A minimum of one 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. If a sight glass cannot be provided, then please state how coolant level can be visually checked. A spring-loaded, push button type valve or a lever type safety release to safely release pressure or vacuum in the cooling system shall be provided, with water filler, no more than 60 inches above the ground and both shall be accessible through the same access door. New Flyer is approved to provide visibility to the surge tank sight glass by opening the surge tank door located at the rear roadside corner of the coach.

Both the radiator and tubing shall be epoxy coated. Stainless steel tubing is not required to be epoxy coated. The radiator shall be of durable corrosion-resistant construction with bolted-on removable tanks. Modine or Montreal radiators (with their associated plugs instead of peacocks and other manufacturer specific attachments such as road debris deflector are requested) **will be allowed with the provision that the manufacturer will replace them if they fail within five years.** Radiator piping shall be **stainless steel** (preferred), steel, or brass tubing and if practical, rubber hoses shall be eliminated. Necessary hoses shall be premium, silicone rubber type that are impervious to all coach fluids (FC300 are acceptable). All hoses shall be secured with "Breeze Constant Torque" premium, stainless steel, wide band type clamps with a collared screwdriver head, or approved equal. No heat producing components or climate control system components shall be mounted between the engine cooling air intake aperture and the radiator. The coolant system shall be equipped with gate valves in the heating and defroster lines. Oetiker Clamps are acceptable. Modine Gen. 2 electric cooling fans are preferred.

New Flyer's EMP Electric Cooling System is an accepted alternate.

No heat producing components or climate control system components will be mounted between the engine cooling air intake aperture and the radiator(s). All cooling system fittings are to be cast iron

or brass.

The coach will be delivered with 50-50 mixture of water and ethylene glycol (green in color) antifreeze recommended by the engine and transmission manufacturer.

The cooler can be located in front of the radiator.

- 7) **Transmission:** The transmission shall be a Voith D864.6 or Voith DIA W4, D864. An ATF extraction fitting shall be attached externally to the valve body of the transmission. Electrically operated driver gear selector is acceptable. A 3M mechanic, with optional assistance, shall be able to remove, replace, and prepare the transmission assembly for service in less than ten total combined man-hours. The transmission shall operate for 150,000 miles on the design operating profile without repairs. The side panels of the engine compartment shall be ventilated to allow outside air to flow across power unit. The panel shall be screened in such a way to prevent manual access into the engine compartment with the panel in the closed position. A retarder is required and there will be an amber LED light on the exterior of the bus (upper right rear) that is lit when the retarder is in use bidders shall run the wiring for this and provide the light as well as the mounting hole, the DTA will install the light). At procuring agency option, this pre-wiring shall be deleted. The transmission shall be equipped with a drain plug on the tongue converter. New Flyer's ATF extraction fitting attached externally to the main transmission case is approved, as is the ventilated side panel on streetside to allow outside air to flow across the power unit. An integrated Voith transmission cooler is approved, along with two required mufflers (to meet 2010 EPA emission requirements).

If the Offeror proposes a Transmission other than that specified by the DTA the Offeror must provide the DTA with the following information before their request will be considered:

- a. Full technical specifications of the transmission being proposed.
- b. The length of the warranty period and the name of the local service representative that will be handling the transmission during the warranty period.
- c. Parts manual and price catalogue showing the cost of transmission parts.
- d. Additional training that will be provided to the DTA

A large external repairable (rebuildable) heat exchanger will be provided which is capable of cooling the transmission.

The transmission gear selection controls will be electronic and meet or exceed the requirements of FMVSS 102. The transmission will be equipped with a starter interlock to prevent starting the coach unless the transmission is in neutral.

The transmission will be equipped with a disposable filter that may be top loading. The filter will be mounted in a location which is convenient for servicing. In lieu of a dipstick the bidder will provide an electronic transmission gauge to measure the correct fluid levels.

All major repairs to the transmission during the warranty period will be the responsibility of

the Offeror. The Offeror will provide full details on the warranty center the Offeror is proposing to use.

- 8) **Engine Compartment Ventilation:** The left-hand side of the engine compartment shall be ventilated to allow outside air to flow into the radiator. The panel shall be screened in such a way to prevent manual access into the engine compartment with the panel in the closed position.

1.27 Emissions

- 1) **Gas and Smoke:** The bus shall meet all applicable emission standards required by the Federal government.
- 2) **Exhaust Location:** Exhaust gases and waste heat shall be discharged by an exhaust above the top of the bus rear roof.
- 3) **Exhaust System:** A stainless steel single muffler shall be provided.
- 4) **Exterior Noise:** Airborne noise generated by the bus and measured from either side shall not exceed 83 Dba under full power acceleration when operated at or below 35 mph at curb weight, just prior to transmission up shift.

1.28 Final Drive

- 1) **Rear Axle:** Rear axle shall be heavy-duty low-profile axle manufactured by Arvin-Meritor 79163 or approved equal. Load rating shall be sufficient for the bus loaded to GVWR. Ring gear must be **bolted** instead of riveted or welded. Transfer of gear noise to the bus interior shall be minimized. The driven axles shall operate for 300,000 miles on the design operating profile without repairs. Wheels bearing inner grease seal shall run on a replaceable wiper ring or the tube. The axle ratio shall be determined after contract signing with the intent of a maximum speed of 60 mph and low end power **for Duluth, Rochester, and "basic" bus.**

Minimums (for 40 foot fully loaded buses):

Speed at 5% grade – 35 MPH

Speed at 4.47% grade – 38 MPH

Speed at 8.25% grade – 18 MPH

Speed at 10% grade – 16 MPH

- 2) **Propeller Shaft:** Propeller shaft shall be a minimum of 3.5-inch O.D. heavy duty type utilizing Spicer 1710 Series or 1700 series universal joints, or equal. The drive shaft shall be guarded to prevent striking the floor of the bus or the ground in the event of a tube or universal joint failure. It shall be flanged or yoke mounted to the axle and yoke mounted to the transmission.

1.29 SUSPENSION

- 1) **General Requirements:** The front axle shall be an Arvin-Meritor FH946 or approved equal, solid beam type axle with air suspension, non-driving with a load rating sufficient for the bus loaded to GVWR. Both the front and rear axle suspensions shall be pneumatic type. The basic suspension system shall last the life of the bus without major overhaul or replacement. Items

such as bushings and air springs shall be easily and quickly replaceable by a 3M mechanic. Adjustment points shall be minimized and shall not be subject to a loss of adjustment in service. Necessary adjustments shall be easily accomplished without removing or disconnecting the components. Front and rear axles equipped with oil seals are preferred, but M.A.N. axles without oils seals are accepted. O & S radius rods are acceptable.

- 2) **Regulation and Operation:** The pneumatic system shall be regulated by levelling valves (warranties for 150,000 miles) located at front and rear wheel locations. The suspension system shall maintain a constant floor height in relation to the axles regardless of load. The source of air shall be the accessory air tank, and a pressure regulating valve shall protect against air loss from leaks in the suspension air springs. Warranty for consumable components one year or 50,000; structural members three years or 150,000; and structural (except where covered elsewhere in this specification) is seven years or 350,000. MAN axles with grease lubricated bearings are acceptable. ZF- LEMFORDER supplied radius rods with tensile strength of 70,000 lbs. are also approved.
- 3) **Travel:** The suspension system shall permit a minimum wheel travel of 3.5-inch in jounce and 3-inches in rebound. Elastomeric bumpers shall be provided at the limit of jounce travel. Rebound travel may be limited by elastomeric bumpers or hydraulically within the shock absorbers. Suspensions shall incorporate appropriate devices for automatic height control so that regardless of load the bus height required elsewhere.
- 4) **Kneeling:** A driver-actuated kneeling device shall lower the bus during loading or unloading operations regardless of load to a floor height of 12.5 inches measured at the longitudinal centerline of the front door. A kneeler is not required if the floor height is 11.5 inches or less off the pavement. Brake and throttle interlock shall prevent movement when the bus is kneeled. The bus shall kneel and rise at an essentially a constant rate. After kneeling, the bus shall rise within two seconds to a height permitting the bus to resume service and shall rise to the correct operating height within five seconds. During the lowering and raising operation, the maximum acceleration shall not exceed 0.2g and the jerk shall not exceed 0.3g/sec. measured on the front doorstep tread. An indicator visible to the driver shall be illuminated until the bus is raised to a height adequate for safe street travel. Manufacturer to provide and install both audible and visual warning devices that operate together with the kneeling system. Devices are to be easily seen and heard by boarding passengers at the front door. Audible devices are to be an identical beeping or buzzing tone on all buses. Both devices to be operated from a single control mechanism/switch.
- 5) **Damping:** Vertical damping of the suspension system shall be accomplished by hydraulic shock absorbers mounted to the suspension arms or axles and attached to an appropriate location on the chassis. Damping shall be sufficient to control coach motion to four cycles or less after hitting road protuberances. Shock absorbers shall maintain their effectiveness for at least 50,000 miles in normal service, and each unit shall be replaceable by a 2M mechanic in less than 15 minutes.
- 6) **Lubrication:** All elements of steering, suspension, and drive systems requiring scheduled lubrication shall be provided with grease fittings conforming to SAE Standard J534. These fittings shall be located for ease of inspection and shall be accessible with a standard grease gun with or without flexible hose end from a pit or with the bus on a hoist. Each element requiring lubrication shall have its own grease fitting with a relief path. Lubricant specified shall be standard for all elements serviced by standard fittings.

1.30 Steering

- 1) **Strength:** Fatigue life of all steering components shall exceed 1,000,000 miles. No element of the steering system components shall fail before suspension system components when one of the tires strikes a severe road hazard.
- 2) **Turning Radius:** Outside body corner turning radius for a standard configuration for 40ø long bus shall not exceed 45.5ø at SLW and for a 35ø long bus, shall not exceed 39ø at SLW.
- 3) **Design:** Steering column is to be Douglas Model 909, Model 929 or approved equal (including the TRW model with the same features), tilt-type design and telescoping, with four positions, for maximum adaptability to individual drivers. When steering column location is selected a positive lock shall engage to prevent inadvertent movement of column.
- 4) **DTA is requesting 45-degree grease fittings** at the U-joints within the steering column and linkage.
- 5) **Turning Effort:** The steering wheel shall be no less than 20-inches in diameter and shall be shaped for firm grip with comfort for long periods of time. The steering wheel shall be removable with a standard or universal puller.

Hydraulically assisted power steering shall be provided. The steering gear shall be an integral type with flexible lines eliminated or the number and length minimized. Steering torque applied by the driver shall not exceed 10-foot pounds with the front wheels straight ahead to turned 10°. Steering torque may increase to 70-foot pounds when the wheels are approaching the steering stops. Steering effort shall be measured with the bus at SLW, stopped with the brakes released and the engine at normal idling speed on clean, dry, level, commercial asphalt pavement and the tires inflated to recommended pressure. Power steering failure shall not result in loss of steering control. With the bus in operation, the steering effort shall not exceed 55 pounds at the steering wheel rim and perceived free play in the steering system shall not materially increase as a result of power assist failure. Gearing shall require no more than seven turns of the steering wheel lock-to-lock.

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

1.31 BRAKES

- 1) **Actuation:** Service brakes shall be controlled and actuated by an air system. The system shall be balanced with no front/rear displacement. E10, Bendix E6, E8P, E15 (E10P, OR1, R14, & SR1 are also acceptable) brake valves are required. Force to activate the brake pedal control shall be an essentially linear function of the bus deceleration rate and shall not exceed 70 pounds at a point 7-inches above the heel point of the pedal to achieve maximum emergency braking. Microprocessor controlled Antilock Braking System (ABS) shall be provided. The microprocessor for the ABS system shall be protected yet in an accessible location to allow for ease of service. The total braking effort shall be distributed between all wheels in such a ratio as to ensure equal friction material wear rate at all wheel locations. The DTA understands that based on axle load tire from front to rear axle and single tire on front versus dual tire on rear,

rear axle friction material wears faster than the front axle friction material.

Microprocessor-controlled Automatic Traction Control (ATC) shall be available as an option. Four-wheel disc brakes shall be available as an option, including allowance for machining up to 1/4-inch on each side.

Activation of the ABS and/or ATC shall override the operation of the brake retarder.

New Flyers front and rear disc brake systems, including the brake caliper, brake carrier, disc pads, brake disc and brake chamber, are accepted.

- 2) **Friction Material:** The entire service brake system, including friction material, shall have an overhaul or replacement life of at least 30,000 miles when running on the design operating profile. Brakes shall be self-adjusting throughout this period. Heavy duty Haldex automatically adjusted brake slack adjusters are preferred. The slack adjusters will have the proper rated inch point torque specification and be of the proper length to provide the necessary leverage and to avoid excessive travel of brake diaphragm. Levers will not have more than one hole and it will be properly bushed. The slack adjusters will not be repairable and have a grease fitting for periodical lubrication and will have a normal replacement life of 100,000 miles. The S-cam (Quick-cam) brakes are preferred.

Brake lining must be designed and approved for use on the vehicle being proposed. Brake lining must provide optimum performance with the brake system being used and will minimize brake noise under all weather conditions. Non asbestos material will be used in the brake lining. Tenneco Brake block is requested. Front and rear brake material must be the same. Abex 931 and Haldex, as well as Cast Plus, Carlisle, and Jurid brake materials are acceptable. Knorr cylinder with Ferodo lining are accepted.

- 3) **Hubs and Drums:** Front hubs will be of the type that can be disassembled to remove bearings, races, and seals. Both front and rear axles shall have oil seals.
- 4) **Air System:** The bus air system shall operate all accessories and the braking system with reserve capacity. This system shall be equipped with a remote air hook-up, Schrader type located in the engine compartment that will allow hook-up for auxiliary air. The engine-driven air compressor shall be sized to charge the air system from 40 psi to the governor cut-off pressure in less than three minutes while not exceeding the engine's rated speed. Regardless of the system's air pressure, idle up to the rated engine speed shall be available to the driver with the transmission in neutral and the parking brake applied. The air system shall have an oil separator. ADIT High cycle required. Contact Jim Caywood at 218-623-4332 for further information.

Two air tanks shall supply air for the vehicle's air suspension system, windshield wipers, door operating mechanism and brake system. These air tanks will be mounted in the ceiling behind the interior fluorescent lights, easily accessible for inspection and maintenance. Air tank sizing and plumbing will be in accordance with the requirements of the FMVSS-121.

Check valves shall be furnished between the first and all other air tanks and shall be located adjacent to the other tanks. First air tanks shall have 150 psi safety valve. All air tanks to be equipped with quality brass petcock type drain cocks.

Air lines, except necessary flexible lines, shall conform to the installation and material requirements of SAE Standard J844 Type 1 for copper tubing with standard, brass, flared or ball sleeve fittings, or SAE Standard J844 Type 3B for nylon tubing if not subject to temperatures over 200°F. Accessory and other non-critical lines may use Type 3A tubing. Nylon tubing shall be installed in accordance with the following color-coding standards:

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

Line supports shall prevent movement, flexing, tension strain, and vibration. Copper lines shall be supported to prevent the lines from touching one another or any component of the bus. Looms are not required on copper lines; copper lines are supported with P clips. To the extent practical and before installation, the lines shall be pre-bent on a fixture that prevents tube flattening or excessive local strain. Copper lines shall be bent only once at any point, including pre-bending and installation. Rigid lines shall be supported at no more than 5-foot intervals.

The compressor discharge line between powerplant and body-mounted equipment shall be flexible convoluted copper or stainless-steel line or may be flexible Teflon hose with a braided stainless-steel jacket. Other lines necessary to maintain system reliability shall be FC 300 hose. End fittings shall be standard SAE or JIC brass or steel, flanged, reusable, swivel type fittings. Flexible hoses shall be as short as practical and individually supported. They shall not touch one another or any part of the bus except for the supporting grommets. Flexible lines shall be supported at 30-inch intervals or less. Air lines shall be cleaned and blown out before installation and shall be installed to minimize air leaks. New buses shall not leak down more than 6 psi as indicated on the instrument panel mounted air gauges, within 15 minutes from the point of governor cut-off.

All air lines shall be sloped toward a reservoir and routed to prevent water traps wherever practical. Grommets shall protect the air lines at all points where they pass through understructure members. Provision shall be made to apply shop air to the bus air systems using a standard tire inflation type valve. This valve shall be conveniently located in the engine compartment and shall include a 3/8-inch FIP fitting ahead of the tire inflation valve.

Air for the compressor shall be filtered through the main engine air cleaner system. All air reservoirs shall meet the requirements of SAE Standard J10 and shall be equipped with clean-out plugs and guarded or flush type drain valves. These valves and any automatic moisture ejector valves shall be protected from road hazards by major structural members. Reservoirs shall be sloped toward the drain valve. The air system shall be protected by a pressure relief valve set at 150 psi and shall be equipped with check valves and pressure protection valves to assure partial operation in case of line failures. Gillig's Standard air system is acceptable. New Flyer is approved to supply air reservoirs mounted in the roof structure with four (4) drain valves located approximately at the lower edge of the vehicle.

An air dryer shall prevent accumulation of moisture in the air system. It shall have a dual filter (ADIT Bendix designed for buses) and be designed for buses. It shall be vertical-mount, desiccant type with replaceable desiccant cartridge and thermostatically controlled heater element. It shall have automatic purge and drain cycle and be cleanable through the bottom of the unit.

- 5) **Parking Brake:** The parking brake shall be an air release, spring applied drum type mounted to the rear axle drum assembly. The parking brake shall be controlled by a push-pull air valve at the driver's location. This brake shall comply with requirements of FMVSS-121. The parking brake system should use the rear axle drum brakes and spring brake chambers.
- 6) **Wheels and Tires:** Painted or powder coated steel wheels as manufactured by Accuride shall be provided. Wheels shall be size 22.5" X 8.25", accommodate tubeless tires, are ten stud and be hub pilot mounted. Wheel hubs shall be painted. Duluth will be using leased tires. Bridgestone/Firestone 315/80R 22.5 City Transport radial are acceptable.

Options shall be available for polished Aluminum (Alcoa Durabrite) wheels and for purchased tires (Michelin/Bridgestone/Firestone acceptable).

1.32 GENERAL CHASSIS

- 1) **Fuel Tank:** The fuel tank and straps shall be of stainless steel and generously undercoated, shall be securely mounted to the bus to prevent movement during maneuvers, but shall be easily removable for cleaning or replacement by a 2M mechanic in 1.5 hours or less. Plastic fuel tanks and straps may be permitted, provided they are warranted to be as durable as stainless steel. Fuel tank capacity shall be at least 100 useable US gallons. The fuel tank shall be equipped with an external, hex head, brass drain plug. It shall be at least a 3/8-inch size and shall be located at the lowest point of the tank. The tank shall have an inspection plate or removable filler neck to permit cleaning and inspection. The tank shall be baffled internally to prevent fuel sloshing noise regardless of fill level. The baffles or fuel pickup location shall assure continuous full power operation on a 6% downgrade for 30 minutes starting with no more than ten gallons of fuel over the unusable amount in the tank. All fuel lines shall be stainless steel or Areo Quip FC350 hose. Fuel lines between the tank and engine bulkhead nylon fuel grade lines (orange) and FC355 hoses in the engine compartment are approved. A heated fuel processor is required.
- 2) **Fuel Filler:** The fuel filler shall be located behind the rear door on the right side of the bus. The filler cap shall be recessed into the body so that spilled fuel will not run onto the outside surface of the bus. The filler shall accommodate a 1½-inch diameter nozzle and a fill rate of 25 gallons per minute of foam-free fuel without spitting back or causing the nozzle to shut off before the tank is full. An audible signal shall indicate when the tank is essentially full. The fuel lines forward of the engine bulkhead shall be in conformance to SAE Standard J844-Type 1 for copper tubing or SAE Standard J844-Type 3B for nylon tubing color coded orange or Areo Quip FC350 hose.

An option for the Emco-Wheaton Posi-Lock dry break fuel system shall be available.

- 3) **Fuel Filters:** Two engine-mounted fuel filters are required. A primary filter and the secondary filter both of which incorporate spin-on type elements shall be provided. The secondary filter shall have a threaded pipe plug on the side of the housing to permit check fuel pressure with a pressure gauge. Both shall have shut-off valves. The standard Cummins L9 remote mounted fuel filter is also acceptable.

1.33 BUMPER SYSTEM

- 1) **Location:** Bumpers shall provide impact protection for the front and rear of the bus up to 26 inches above the ground. The bumpers shall wrap around the bus **to the extent practical without exceeding allowable width**. They will be Romeo Rim help bumpers or approved equals.
- 2) **Front Bumper:** No part of the bus, including the bumper, shall be damaged as a result of a 5-mph impact of the bus at curb weight with a fixed, flat barrier perpendicular to the bus' longitudinal centerline. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the striker defined in FMVSS #301 loaded by 4,000 pounds parallel to the longitudinal centerline of the bus and 5.5 mph impacts into the corners at a 30 degree angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system and shall not require service or maintenance in normal operation during the service life of the bus. The flexible portion of the bumper may increase the overall bus length specified by no more than 6 inches. All bumpers shall be black in color.
- 3) **Rear Bumper:** The rear bumper and its mounting shall provide impact protection to the bus at curb weight from a two-mph impact with a fixed, flat barrier perpendicular to the longitudinal centerline of the bus. When using yard tug with a smooth, flat plate bumper 2 feet wide contacting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to five mph, over pavement discontinuities up to 1-inch high, and at accelerations up to two mph/sec. The rear bumper shall protect the bus, when impacted anywhere along its width by the striker defined in FMVSS #301 loaded to 4,000 pounds, at four mph parallel to the longitudinal centerline of the bus or into the corners up to a 30° angle to the longitudinal centerline. The rear bumper or bumper extensions shall be shaped to preclude unauthorized riders standing on the bumper. The bumper shall be independent of all power systems and shall not require service or maintenance in normal operation during the service life of the bus. Any flexible portion of the bumper may increase the overall length specified by no more than 6-inches.
- 4) **Bumper Material:** Bumper material shall be corrosion resistant. Visible surfaces shall be black. These qualities shall be sustained throughout the service life of the coach.

1.34 ELECTRICAL SYSTEM

- 1) **General Requirements:** The VCOM and Vansco multiplex electrical systems are acceptable, as is the I/O Control (Dinex) system. The electrical system shall provide and distribute power to ensure satisfactory performance of all electrical components. The system shall supply a nominal 12 and 24 volts of direct current. Electrical power provided for the fare collection device and the radio compartment shall be 12 volts, D.C. Precautions shall be taken to minimize hazards to service personnel. The power generating system shall be rated sufficiently higher than the total possible electrical load to maintain the charge on the batteries at all operating conditions including the engine at idle. All circuits, except for those involved in propulsion system start-up, shall be protected by circuit breakers or fuses. Fuses shall be used only where it can be demonstrated that circuit breakers are not practical, and they shall be easily accessible for replacement. All electrical systems and components shall be properly identified and labelled.
- 2) For Duluth buses, provide a J1939 connection point in the front street side wheel well storage box.

- 3) For Duluth Buses, provide an Auxiliary Gateway I/O module in the front street side wheel well storage box for future telematics connections.

Redundant grounds shall be used for all electrical equipment, except where it can be demonstrated that redundant grounds are not feasible or practical. One ground may be the body and framing. Grounds shall not be carried through hinges, bolted joints (except those specifically designed as electrical connectors), or powerplant mountings. Electrical equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electrical system. Major wiring harnesses shall not be located under the floor, and under-floor wiring shall be eliminated to the extent practical. Wiring and electrical equipment necessarily located under the bus shall be insulated from water, heat, corrosion, and mechanical damage.

- 4) **Modular Design:** Design of the electrical system shall be modular so that each major component, apparatus panel, or wiring bundle is easily separable with standard hand tools or by means of connectors. Each module, except the main body wiring harness, shall be removable and replaceable in less than 60 minutes by a 3M mechanic. Powerplant wiring shall be an independent wiring module.
- 5) **Wiring and Terminals:** All wiring between major electrical components and terminations, except battery wiring, shall have double electrical insulation, shall be waterproof, and shall meet specifications requirements of SAE Recommended Practice J555 and J878-Type SXL. Except as interrupted by the master battery disconnect switch, battery and starter wiring shall be continuous cables with connections secured by bolted terminals and shall conform to specification requirements of SAE Standard J1127-Type SGT or SGX and SAE Recommended Practice J541, grouped, numbers, and/or color-coded full length. Installation shall permit ease of replacement. All wiring harnesses over 5-feet long and containing at least five wires shall include 5% excess wires for spares that are the same size as the largest wire in the harness excluding the battery cables.

Wiring harnesses shall not contain wires of different voltages unless all wires within the harness are sized to carry the current and insulated for the highest voltage wire in the harness. Double insulation shall be maintained as close to the terminals as practical. The requirement for double insulation shall be met by wrapping harnesses with plastic electrical tape or by sheathing all wires and harnesses with non-conductive, rigid or flexible conduit. Grommets of elastomeric material shall be provided at points where wiring penetrates metal structure. Wiring supports shall be non-conductive. Precautions shall be taken to avoid damage from heat, water, solvents, or chafing. Wiring length shall allow replacement of end terminals twice without pulling, stretching, or replacing the wire. Except for those on large wires such as battery cables, terminals shall be crimped to the wiring and may be soldered only if the wire is not stiffened above the terminal and no flux residue remains on the terminal. Terminals shall be full ring type or interlocking and corrosion-resistant. "T" Splices may be used when it is less than 25,000 circular mills of copper in cross-section: a mechanical clamp is used in addition to solder on the splice; the wire supports no mechanical load in the area of the splice; and the wire is supported to prevent flexing. All wiring shall be color coded and/or numbered so as to be identical from one bus to the next. Wiring that meets SAE GXL is approved, except where connection systems specified by major vendors prohibit the use of such wire.

- 6) **Junction Boxes:** All relays, controller, flashers, automatic or manual resetting circuit breakers,

and other electrical components should be mounted in easily accessible junction boxes. The boxes shall be sealed to prevent moisture from normal sources, including engine compartment cleaning, from reaching the electrical components and shall prevent fire that may occur inside the box from propagating outside the box. The components and circuits in each box shall be identified and their locations recorded on a schematic drawing permanently glued to or printed on the inside or outside of the box cover or door plastic coated schematics placed rather than glued are also acceptable. The drawing shall be protected from oil, grease, fuel, and abrasion. If the junction box is located along the left side wall, it shall be replaceable as a unit in less than 25 minutes by a 3M mechanic. A rear start and run control box shall be mounted in an accessible location in the engine compartment. New Flyer is approved to provide standard panel decals for the fusebox and rear PLC panel.

- 7) ***Programmable Logic Control System:*** The bus shall be equipped with an IO Controls Corp. or Allen Bradley industrial programmable logic control system that will have the ability to talk to various modules located throughout the bus that can store and retrieve data for the mechanical and electrical functions of the bus. The system shall be so designed to significantly reduce the connectors, circuit breakers and wiring harnesses of a standard bus. It shall have the capability to quickly trouble-shoot electrical failures for the mechanic and notify maintenance when an electrical component has failed.

The system shall have the capability to download information to in-house computer system per bus and automatically determine mechanical failures. A programmable controller shall be located in a sealed compartment in the rear of the interior of the coach.

The manufacturer shall provide training on the programming of components and the report formatting and usage of the system.

1.35 ELECTRICAL COMPONENTS

- 1) ***General Requirements:*** All electrical components, including switch, relays, flashers, and circuit breakers, shall be heavy-duty designs. To the extent practical, these components shall be designed to last the service life of the bus and shall be replaceable in less than five minutes by a 3M mechanic. Sockets of plug-in components shall be polarized where required for proper function and the components shall be positively retained. All electric motors, except cranking motors, shall be heavy-duty brushless type. Electric motors shall be located for easy replacement and except for the cranking motor the brushes shall be replaceable in less than 15 minutes by a 3M mechanic without removing the motor.

Dual electric horns will be provided. Horns will be positioned to be protected from road hazards and the elements. The horn trumpets will be down turned to assure drainage of any moisture that may enter.

- 2) ***Batteries:*** Batteries shall be mounted on a stainless steel, sliding battery tray in the engine compartment or under the operator's area with the stud terminals toward the rear of the coach. Batteries shall be held in position by tray separators and retained to the tray by hold down brackets.

AGM gel cell batteries are required with top mount connections and moulded handles shall be

provided. Different sized positive and negative posts will be provided. Battery cables shall be 4/0 or better extra flexible cables with neoprene jackets.

A master battery switch shall be provided near the batteries for complete disconnecting from all electrical systems. The master switch shall be accessible in less than ten seconds for activation. The master switch shall be capable of carrying and interrupting the total circuit load. Opening the master switch with the powerplant operating shall not damage any component of the electrical system. For jumping the vehicle there will be a "quick connect system" installed. The connectors will be colored red.

- 3) **Capacitor:** For the Duluth buses, a KBi Super Capacitor KA Power @ 122kJ or approved equal shall be installed in the battery box top tray to aid engine starting.
- 4) **Radio Noise Suppression:** Proper suppression equipment shall be provided in the electrical system to eliminate interference with radio and television transmission and reception. This equipment shall not cause interference with any electronic system on the coach.
- 5) **Fire Detectors:** At least two temperature-sensitive sensors or linear wire will be provided. They will be located in the engine compartment under all horizontal bulkheads, above and downwind of the major heat sources, and in areas likely to be wetted by leaking flammable fluids. Additional sensors will be located in other potentially critical areas. The sensors will detect high temperature in the critical areas and will activate the fire alarm bell and warning light in the driver's compartment. The sensors will return to normal setting and deactivate alarms when the temperature returns to normal.
- 6) **Farebox Collection:** Space as far forward as practical with structural provision shall be provided for installation of an electronic registering farebox system. The manufacturer will provide a 10 amp, 12-volt, DC protected circuit to power the farebox. The floor under the farebox will be reinforced, as necessary using a 1/8-inch steel plate welded to the chassis to provide a sturdy mounting platform. The farebox is 40.5 inches high and the pedestal should be 6 inches high. Farebox power shall be supplied directly from the battery and independent of the master run switch and master battery switch.
- 7) **This option must be included in the DTA vehicles. Fire Detection and Suppression System (Amerex V25 or Kidde Dual Spectrum shall be available at purchasing agency option):** A Fire Sensing and Suppression System (FSS) shall be provided to monitor the engine compartment and auxiliary areas where a significant fire hazard exists. Upon detection, the system will alert the operator with visual and audible signals and initiate automatic engine shutdown, fuel shut-off, and extinguisher discharge sequences. The DTA requests the Amerex V25 system.

A) Fire Detection

Both thermal and optical fire detection shall be supplied.

Thermal fire detectors shall be spot (one-dimensional detection) or linear (two-dimensional detection) designed for use in engine compartments. Thermal fire detectors must be in close proximity to the fire in order to detect. Their mounting locations must be chosen per the installation instruction, certified by the manufacturer, and typically mounted so that airflow will

act to move a fire in the protected area toward them. The thermal detector shall respond to being immersed in a fire in less than thirty seconds. The thermal detection system in the engine compartment will be comprised of at least two each spot detectors or one linear detector of suitable length.

Optical fire detectors shall sense infrared radiation emitted from a fire (three-dimensional detection) and be designed for use in engine compartments. Optical fire detectors must be able to view a fire in order to detect and must be mounted per the installation instructions. The optical detector shall have at least a 90 degree conical field-of-view. The optical fire detector shall have a response time of less than one half of one second to a fire. The optical detection system in the engine compartment will be comprised of at least two each infrared optical fire detectors.

Fire detection sensors shall be located in an area not subject to corrosion.

B) SYSTEM ACTION

The FSS will detect fires in the protected areas. Upon detection, the system will alert the operator with visual and audible signals and initiate automatic engine shutdown, fuel shut-off, and extinguisher discharge sequences.

Alarm Indication: Upon detection of a fire, the system will provide a visual and audible fire alarm to the operator.

System Status and Trouble Indication: The status of the FSS shall be verified by inspection during maintenance.

Automatic Engine Shut-Down: After a fire is detected, the FSS shall cause the fuel flow to cease, and the engine to shut down. An operator override feature shall be provided. An automatic delay between the fire alarm and engine shutdown shall not exceed 30 seconds.

Extinguisher Discharge: The system shall provide a means for manually discharging the extinguisher with the control located in the driver's area. The installation shall be certified by the manufacturer of the suppression system

System Reset: After a fire alarm and complete system sequence, the FSS shall have provision to be reset after the system is reconfigured per the instructions provided by the manufacturer.

C) FIRE SUPPRESSION SYSTEM

The fire suppression system shall be pre-engineered and designed for vehicle applications. The system shall have a minimum capacity of 20 pounds of BC or ABC dry chemical agent. System cylinder shall have a minimum service pressure of 350 psi and be DOT rated. Nozzles and distribution shall be installed in accordance with the installation manual. Stored pressure type extinguishing units shall be provided with a gauge that can be visually inspected for pressure condition. The DTA requests the Americ V25 system.

1.36 INTERIOR CLIMATE CONTROL

- 1) **Capacity and Performance:** The interior climate control system will maintain the interior of the coach at a level suitable for all climatological conditions found in Minnesota and Wisconsin.

The heating, ventilating, and cooling systems shall maintain an average passenger compartment temperature between 65⁰ F and 78⁰F with a relative humidity of 50% or less. The system shall maintain these conditions in ambient temperatures of -30⁰F to 95⁰F with ambient humidities of 5 to 50% while the coach is running on the design operating profile with a full standee load of passengers. In ambient temperatures of -10⁰ to 40⁰F, the average interior temperature shall not fall below 55⁰F while the coach is running on the design operating profile with no passengers. The temperatures measured from a height of 6ö below the ceiling shall be within ±5⁰F of the average temperature at the top surface of the seat cushions. Temperatures measured more than 3ö above the floor shall be within ±10⁰F of the average temperature at the top surface of the seat cushions. The interior temperature, from front to rear of the coach, shall not vary more than ±5⁰F from the average. Supplemental heat will be provided to the passenger area with a Webasto 300, 104,000 BTU heater. A shut-off valve shall be provided for these units. Two under seat units are required. A light on the dash showing when the heaters are activated is required.

The cooling mode shall be capable of reducing the passenger compartment temperature from 110⁰ to 90⁰F in less than 20 minutes after engine start-up under the following conditions. Engine temperature shall be within the normal operating range at the time of start-up of the cool down test and the engine speed shall be limited to fast idle that may be activated by a driver-controlled device. During the cool down period the refrigerant pressure shall not exceed 400 psi and the condenser discharge air shall not exceed 145⁰F, measured 6 inches from the surface of the coil. The coach shall be parked in direct sunlight with the ambient temperature at 100⁰F and humidity less than 20%. There shall be no passengers onboard and the doors shall be closed. The cooling mode may operate independent of the propulsion system and outside air may be cut off during the cool down period. Thermo King is the DTA's choice for air conditioning system.

The pull up requirements for the heating system shall be in accordance with Section 9 of the APTA document, "Recommended Instrumentation and Performance Testing for Transit Bus Air Conditioning System." With ambient temperature at 620F, and vehicle cold soaked at that temperature, the bus heating system shall warm the interior passenger compartment to an average temperature of 70±2 degrees F within 70 minutes.

The climate control system shall be highly reliable since most failures are Class 2. Manually controlled shutoff valves in the refrigerant lines shall allow isolation of the compressor and receiver for service. To the extent practical, self-sealing couplings shall be used to break and seal the refrigerant lines during removal of major components such as the refrigerant compressor or condenser. The condenser shall be located to efficiently transfer heat to the atmosphere and shall not ingest air warmed by the coach mechanical equipment above the ambient temperature or discharge air into any other system of the coach. The location of the condenser shall preclude its obstruction by wheel splash, road dirt or debris.

Manually controlled valves shall have shutoff valves in the refrigerator lines to allow isolation of the compressor and receiver for service. The condenser will be located in the rear, of the coach top to efficiently transfer heat to the atmosphere and will not ingest air warmed by coach's mechanical equipment above the ambient temperature or discharge air into other systems of the coach.

The air conditioning unit will be the Thermo King Intelligaire II Unit with Thermo King brushless motors. IN ALL CASES R134A MUST BE THE REFRIGERANT.

Air Conditioning Evaporators (Thermo King): The air conditioning evaporators will be located in the rear of the coach in a location designed for ease of maintenance of the evaporators, the expansion valve, the return air filters, the electric controls and the blower motors (brushless). The DTA will not accept the mounting of the evaporators on the roof of the coach. The evaporators will incorporate, as part of their design a drainage tube of sufficient size to remove all condensation.

Air Conditioning Compressor (Thermo King): Screw type required. The air conditioning compressor will have a minimum displacement of 25 cubic inches. The compressor must be designed to allow its engagement at any speed without damage to the compressor or any other components in the coach. The compressor must have a minimum useful life of five years on the standard operating profile. To facilitate the servicing of the compressor two back seated valves will be provided at the compressor to allow the compressor to be isolated.

Heat shall be applied to the front step tread to prevent accumulation of snow, ice, or slush. Stepwell heat shall be supplied via the supplemental heater and controlled by the driver's heater and defroster system.

A swing-out type guard with a minimum of screws will be provided for easy access to the air conditioning system. The HVAC can be roof mounted and accessed from inside the bus with a lockable access door.

- 2) **Controls:** All interior climate control system requirements shall be attained automatically, the driver shall control only the defroster and driver's heater. The interior climate control system shall switch automatically to the ventilating mode if refrigerant compressor or condenser fan fails. An option shall be available for a four-position controller (Off/Vent/Cool/Heat).

All interior climate controls will be directly under the control of the driver using toggle switches for each function. Actual bus temperatures are controlled by automatic thermostats. New Flyer's rotary switches are approved. These controls are in addition to the front defroster and driver's heater. If the air conditioning system fails, the climate control system will automatically switch to the vent mode.

- 3) **Air Flow, Passenger Area:** The cooling mode of the interior climate control system shall introduce air into the coach at or near the ceiling height at a minimum rate of 25 cubic feet per minute per passenger based on the standard configuration coach with full standee load. The air will be composed of no less than 10 percent outside air. Air flow shall be evenly distributed throughout the coach with air velocity not exceeding 60 feet per minute on any passenger. The ventilating mode shall provide outside air at a minimum flow rate of 20 cubic feet per minute per passenger.

Air flow may be reduced to 15 cubic feet per minute per passenger when operating in the heating mode with full standee load. Heated air introduced into the coach will contain no less than 20 percent outside air. The fans shall not activate until the heating element has warmed sufficiently to assure at 70°F air outlet temperature.

Sufficient floor level heaters shall be provided that evenly supply heated forced air through floor ducts across the length of the bus. Floor ducts may be discontinued at the upper level but

additional provisions to prevent cold floor and ensure temperature uniformity shall be included. Control of the floor level heating shall be through the main heating system electronic control.

- 4) **Driver's Area:** The coach interior climate control system shall deliver at least 100 cubic feet per minute of air to the driver's area when operating in the ventilating and cooling modes. Adjustable nozzles shall permit variable distribution or shutdown of the air flow. Air flow in the heating mode shall be reduced proportionally to the reduction of air flow into the passenger area. The windshield defroster unit shall meet the requirements of SAE Recommended Practice J382, Windshield Defrosting Systems Performance Requirements, and shall have the capability of diverting heated air to the driver's feet and legs. The defroster or interior climate control system shall maintain visibility through the driver's side window. Two dash mounted fans (this is additional fans) will be provided to assist with defrosting the windshield. The switch for the fans will be mounted so that the bus operator does not have to leave the seat to activate the fans. The switch will activate either one or both fans. The fan will be located out of the line of site of the operator and in such a fashion to prevent passengers from touching the fan. This area will also be equipped with a fresh air vent that is easily operable by the driver. The DTA requests that the defrost system be capable of mixing drier outside air during winter months to reduce moisture on the interior windows.
- 5) **Air Intakes:** Outside openings for air intake shall be located on the left side of the vehicle to ensure cleanliness of air entering the climate control system, particularly with respect to exhaust emissions from the coach and adjacent traffic. All intake openings shall be baffled to prevent entry of snow, sleet, or water. The filter shall meet the ASHRAE requirement for 5% or better atmospheric dust spot efficiency, 50 percent weight arrestance, and a minimum dust holding capacity of 120 gram per 1,000 cfm cell. More efficient air filtration may be provided to maintain efficient heater and or evaporator operation. Air filters shall be cleanable and easily removable for service. Moisture drains from air intake openings shall be located so that they will not be subject to clogging from road dirt.
- 6) **Manual Control:** The entire interior climate control system shall be controlled by a switch conveniently located to the driver. This switch shall have only OFF and ON positions. When the switch in ON the interior climate control system shall meet all specification requirements, and when in the OFF position no mechanical system within the climate control system shall be powered. See 1.36(2) for optional 4-way controller.
- 7) **Air Conditioner Compressor:** Screw Type Compressor (S391). A Thermo King X426 or X430 compressor with Thermo king brushless motors shall be provided or approved equal.
 - a) **Fan Motors:** Evaporator and condenser motors shall be brushless permanent magnet motors or newer technology as approved by DTA.

1.37 HORN

Two heavy duty 12- or 24-volt horns, high and low pitch, shall be installed and protected from wheel wash.

1.39 ADDITIONAL EQUIPMENT

1) *Bike Rack Brackets:*

All Duluth Buses are to be equipped with bike rack mounting brackets (20 second bike rack) and bike racks (made of stainless steel with a brushed finish) in the front of the coach. The rack that is acceptable to the DTA is manufactured by Byk Rack or approved equal.

SECTION NUMBER: SPECIAL

SECTION TITLE: TRAINING

All training for base-order buses will take place at the procuring agency's site and references below to "DTA Staff" shall be taken to mean agency and/or contractor staff from the procuring agency.

The Offeror will provide training for both the bus operators and for the mechanics. The operator training will consist of orientation to the coach including the location of all switches, warning indicators, seat adjustment and door control. Orientation will also include a compartment by compartment explanation of the coach and how the climate control system works. The operator orientation will conclude with behind the wheel driving instruction on transmission shifting patterns, the braking system and turns. Offeror will provide minimum of 20 (twenty) hours of operator training at the procuring agency site.

Mechanical training will consist of an on-site instructor who will work with the mechanics and explain each subsystem on the coach including, but not limited to the climate control system, the transmission, the engine, the door control system, the electrical system, the brake system, the air system, and part procedures. The instructor will be on site until the buses are able to be put into service. The training required is: electrical 24 hours; Thermo King 8 hours; wheelchair ramp 8 hours; and Powertrain 24 hours. Powertrain and Thermo King training may be off-site. The trainer will revisit the DTA for supplemental training and to ensure that the DTA is properly maintaining the vehicles and to answer warranty questions as well as technical questions from the maintenance personnel 90 and 180 days after arrival of the last coach unless the property agrees this is not needed. Thereafter a trainer or service representative shall visit each property annually for a period of five years for the same purpose. All training will be scheduled at each property's convenience within one year of delivery.

All instructors must be able to speak English and have a complete understanding of the English language. If the instructor lacks skill or knowledge to provide the required instruction, or cannot communicate with the students, the DTA reserves the right to request that the instruction be repeated. The offeror will be able to provide continual updating of the instruction upon request of the DTA. The cost of additional training will be negotiated with the DTA.

In addition to the above training, the offeror will provide handouts for the mechanics which they will be able to keep. Operator training will be done by DTA Staff who will be trained by the successful bidder.

DOCUMENTATION

In addition to other documents called for in the specification, the contractor shall furnish DTA with six complete sets of wiring schematics, manuals, parts lists, and other information as may be needed for maintenance of the system. Parts book must be broken down by sub-assembly. A CD for these items is also required. Sources for all spare parts shall be identified. Samples of this

documentation shall be submitted for DTA approval prior to the start of installations. If the bidder does not have the in their documentation information from subs, then they must supply similar documentation from that sub.

Operator manuals are also required (5 hard copy and one digital copy).

All training to take place within one year of acceptance of the last vehicle.

Any supplemental training required by the DTA or other procuring agencies will be negotiated at the time in which the DTA or other procuring agencies indicate that such additional training is required.

FINISH AND COLOR

UNDERCOATING

The underneath portion of the under frame and stepwell, including the wheel housings will be sprayed with either fire retardant Ashland Oil and Refining Tectyle 135 or 506G (PPG Corashield is acceptable), a Quaker Koat or Dolchm 7701 Hydro Armor undercoating material or approved equal. All brake components, air tank drains, tube fittings, electrical components and U-joints will be protected before the undercoating is applied and the protection will be removed before the coach is shipped. If other rust proofing is used it must be fully warranted by the manufacturer for 12 years against any failure due to corrosion.

EXTERIOR COLORS

The offeror will submit for review and approval by the DTA, a proposed exterior painting scheme. All exterior paint will be Centari, PPG, PPG Concept, or approved equal. Exact color number will be provided after award of contract. The DTA exterior paint scheme will be white with two Reflective full pigmentation stripes. The stripes shall be made of reflective material. 3M control tac film, or 3M Scotchlite series 680 CR.

INTERIOR COLORS

The ceiling is to be an approved off white. All side walls between the windows and the floor, the rear seat riser, and the modesty panels will be anodized aluminium with a leather grain pattern. Melamine is also acceptable for the side wall. The front dash and ceiling are to be an approved dark color. Paints are to be enamel, with all colors approved by the DTA. The color of floor material will be specified at the time of contract award. As noted, 1/8-inch melamine is acceptable in the interior including the mullions and modesty panels. Final colors will be chosen from standard colors from the successful bidder.

DECALS AND MONOGRAMS

The offeror will not affix to the exterior of the coach any logos or identification without prior written permission of the contract's administrator. The DTA is planning a maximum of two reflective exterior accent stripes. The exterior accent stripes will be painted on the coach.

SPECIAL ATTACHMENT

SECTION NUMBER: 2.1.1.4

SECTION TITLE: SIGNING

The Offeror will supply and affix to the interior and exterior of the coach those decals regarding safety and operating procedures. Said decals will include, but not be limited to the following:

<u>DECAL</u>	<u>NUMBER</u>	<u>LOCATION</u>
a. No Smoking	2	Interior above the driver, Rear bulkhead
b. Watch Your Step	3	Front and rear stepwell, top-most rider of interior steps
c. Fire Extinguisher	1	Front safety compartment.
d. Rear Door Oprtg Instructions	1	Above the rear exit door
e. No standing forwd Yellow Line	1	Above the driver
f. No eating or radio playing on bus	2	Above the driver Rear Bulkhead
g. Please reserve seats for E/H	2	Over forward seats
h. Bus Number	9	Exterior: (4") Left & Right sides below windshield left side front above operator left & right-side rear right side above front door rear center inside fueling door top of bus (center front) (12" lettering)
		Interior: (4") front centered above windshield rear centered above
i. Video surveillance	2	Interior above the driver, Rear bulkhead
j. Diesel fuel only	1	Inside fuel filler door
k. Emergency Exit Instructions	2	Decal ó above inside of doors
l. Emergency Exit Instructions	#	Metal Plate ó riveted to window frame of each egress window

The offeror will affix to the exterior of the coach, the assigned vehicle number on the front, rear, and side of the coach in locations approved by the DTA. The size and number of vehicle decals will be subject to review and approval of the DTA. Additionally, the bus number will also be affixed inside the fueling door.

The offeror will also affix to the interior of the coach above the driver and rear bulkhead the assigned vehicle number. The location and size of the decal will also be subject to the DTA's review and approval.

The buses will be numbered 141 to 150 for Duluth.

WARRANTY

1.1 WARRANTY REQUIREMENTS

Warranties in this document are in addition to any statutory implied warranties, remedies, or warranties imposed on the contractor. Consistent with this requirement, the contractor warrants and guarantees to the DTA each complete coach, and specific subsystems and components as follows: The warranty period starts with the acceptance of the last Coach of each production run or the day each coach is put into revenue service whichever comes first. The DTA's warranty rate charged will be actual wage rate plus average fringe rate as determined under FTA Section 15 reporting. Current DTA base wage rate is \$22.86 and the fringe rate is 72.5% as per FTA reporting standards.

- Complete Coach

The coach is warranted and guaranteed to be free from defects* and related defects** 1 year or 50,000 miles, whichever comes first, beginning on the date of acceptance of each coach**. During this warranty period, the coach will maintain its structural and functional integrity. The warranty is based on regular operation of the coach under the operating conditions prevailing in the procuring agency's locale.

- Subsystems and Components

Should subcontractors be used to provide or perform warranty repairs, the offeror agrees and understands that they are solely responsible for the subcontractor's full compliance with these specifications. The offeror further agrees that the DTA is the final determining authority as to what defects are covered by warranty subject to protest and appeal procedures contained in these specifications and voiding of warranty per Section 1.2 below.***

Specific subsystems and components are warranted and guaranteed to be free from defects and related defects for the times and/or mileage given in the table below.

- For definitions see: Solicitation, Offer and Award/Contractual provisions.

** For acceptance requirements see: Solicitation, offer and award/contractual provisions.

*** Coverage on any vehicle and subsystems is warranted with 100% parts and labor coverage so as no expense is incurred by the DTA for warranty repairs.

Standard warranty does not include consumables.

SUBSYSTEM AND COMPONENT WARRANTY WHICHEVER COMES FIRST

<u>ITEM</u>	<u>YEARS</u>	<u>MILEAGE</u>
Engine	2	100,000
Transmission	2	100,000
Drive Axle	2	100,000
Brake system (excluding friction material)	1	35,000
Air Conditioning System	2 seasons	unlimited
A/C Compressor	2 seasons	unlimited
Basic body structure	3	150,000
Structural Integrity Corrosion	12	500,000

OPTIONAL WARRANTY PACKAGE

<u>ITEM</u>	<u>YEARS</u>	<u>MILEAGE</u>
Engine	5	300,000
Transmission	5	300,000
Drive Axle	2	100,000
Brake system (excluding friction material)	2	100,000
Air Conditioning System	3 seasons	unlimited
A/C Compressor	3 seasons	unlimited
Basic body structure	3	150,000
Structural Integrity Corrosion	7	350,000

Additionally, bidders shall furnish information concerning extended warranties on the engine and transmission.

1.2 VOIDING OF WARRANTY

The warranty will not apply to any part or component of the coach that has been subject to misuse, negligence, accident, or that has been repaired or altered in any way so as to affect adversely its performance or reliability, except insofar as such repairs were in accordance with the contractor's maintenance manuals and the workmanship was in accordance with the recognized standards of the industry. The warranty will also be void if the DTA fails to conduct normal inspections and scheduled preventive maintenance procedures as recommended in the contractor's maintenance manuals. Maintenance records will be available during normal working hours.

1.3 EXCEPTIONS TO WARRANTY

The warranty will not apply to scheduled maintenance items nor to items furnished by the procuring agency such as radios, fareboxes, and other auxiliary equipment, except insofar as such equipment may be damaged by the failure of a part of component for which the contractor is responsible.

1.4 DETECTION OF DEFECTS

If the DTA detects a defect with the warranty periods defined in Section 1.1.1. it will promptly notify the contractor's representative. Within five working days after receipt of notification, the contractor's representative will either agree that the defect is in fact covered by warranty, or reserve judgement until the subsystem or component is inspected by the contractor's representative or is removed and examined at the procuring agency's property. At that time, the status of warranty coverage on the subsystem or component will be mutually resolved between the DTA and the contractor. Work necessary to effect the repairs defined in Section 2.2 will commence within 5 working days after receipt of notification by the contractor.

1.5 SCOPE OF WARRANTY REPAIRS

When warranty repairs are required, the procuring agency and the contractor's representative will agree within five days after notification on the most appropriate course for the repairs and the exact scope of the repairs to be performed under the warranty. If no agreement is obtained within the five-day period, the procuring agency reserves the right to commence the repairs in accordance with Section 2.2.

1.6 FLEET DEFECTS

A fleet defect is defined as the failure of identical items covered by the warranty and occurring in the warranty period in a specified number of coaches. For this contract a fleet defect will be defined as an identical defect occurring in 2 or more of the 10 coaches delivered.

1.6.1 Scope of Warranty Provisions

The contractor will correct a fleet defect under the warranty provisions defined in Section 2.2 of warranty provisions. After correcting the defect, the contractor will promptly undertake and complete a work program reasonably designed to prevent the occurrence of the same defect in all other coaches purchased under this contract. The work program will include inspection and/or correction of the potential or defective parts in all of the coaches.

The warranty on items determined to be fleet defects will be for the remaining term of the original warranty.

1.6.2 Voiding of Warranty Provisions

The fleet defect provisions will not apply to coach defects caused by non-compliance with the contractor's recommended normal maintenance practices and procedures.

1.6.3 Exceptions to Warranty Provisions

Fleet defect warranty provisions will not apply to damage that is a result of normal wear and tear in service to such items as seats, lights, and interior trim.

2.0 REPAIR PROCEDURES

2.1 REPAIR PERFORMANCE

At its option, the procuring agency or its designated representative may require the contractor or its

designated representative to perform warranty covered repairs that are clearly beyond the scope of the procuring agency's capabilities. The work may be done by the procuring agency's personnel with reimbursement by the contractor.

2.2 REPAIRS BY CONTRACTOR

If the procuring agency requires the contractor to perform warranty covered repairs, the contractor's representative must begin the work necessary to make the repairs, within 10 working days after receiving notification of a defect from the procuring agency. The procuring agency will make the coach available to complete repairs timely with the contractor repair schedule.

The contractor will provide, at its own expense, all spare parts, tools and space required to complete repairs. At the procuring agency's option, the contractor may be required to complete repairs. At the procuring agency's option, the contractor may be required to remove the coach from the procuring agency's property while repairs are being effected. If the coach is removed from the procuring agency's property, repair procedures must be diligently pursued by the contractor's representative.

2.3 REPAIRS BY PROCURING AGENCY

2.3.1 Parts Used

If the procuring agency performs the warranty covered repairs, it will correct or repair the defect and any related defects using contractor-specified spare parts available from its own stock or those supplied by the contractor specifically for this repair. Monthly, or at a period to be mutually agreed upon reports of all repairs covered by this warranty will be submitted by the procuring agency to the contractor for reimbursement or replacement of parts. The contractor will provide forms for these reports.

2.3.2 Contractor Supplied Parts

The procuring agency may request that the contractor supply new parts for warranty covered repairs being performed by the procuring agency. These parts will be shipped prepaid to the procuring agency from any source selected by the contractor within 10 working days of receipt of the request for said parts.

2.3.3 Defective Components Return

The contractor may request that parts covered by the warranty be returned to the manufacturing plant. The total cost for this action will be paid by the contractor. Materials should be returned in accordance with the contractor's instructions.

2.3.4 Reimbursement for Labor

The procuring agency will be reimbursed by the contractor for labor. The amount will be determined by multiplying the number of labor - hours actually required to correct the defect by the current per hour, straight wage rate, plus actual fringe benefits in the coach if such action was mechanically necessary and if the coach was in the normal service area. These wage and fringe benefit rates will not exceed the rates in effect in the procuring agency's service garage at the time the defect correction is made.

2.3.5 Reimbursement for Parts

The procuring agency will be reimbursed by the contractor for defective parts and for parts that must be replaced to correct the defect. The reimbursement will be at the invoice cost of the part(s) at the time of repair and will include taxes where applicable and 15 percent handling costs

2.4 WARRANTY AFTER REPLACEMENT/REPAIRS

If any component, unit, or subsystem is rebuilt or replaced by the contractor or by the procuring agency's personnel, with the concurrence of the contractor, the subsystem will have the unexpired warranty period of the original subsystem.

2.5 WARRANTY OF BASIC COACH STRUCTURE

The contractor will warranty the frame and suspension members for 12 years or 500,000 miles, whichever comes first. This warranty will not cover air bags, leveling valves, springs or other normal wearing parts. The contractor is not liable for warranty if the DTA voids the warranty as outlined in Section 1.2. If the frame or suspension fails or shows indication of imminent failure, the DTA will immediately notify the contractor of the said defect. Within ten calendar days the contractor will inform the DTA on how the contractor will repair the coach. Repair of frame and suspension failures will be the responsibility of the contractor. Within 25 calendar days from notification of the defect the contractor will begin the repair of the frame and suspension defects. If the coach with the reported frame and suspension defect is out of revenue service for 35 or more calendar days because of the reported defect, the contractor will have to provide a substitute transit bus of equal seating capacity or directly reimburse the DTA for the cost of leasing a substitute vehicle. The maximum daily reimbursement will be \$250.00. The contractor will have to continue to provide a substitute vehicle(s) or reimburse the DTA until the defect is completely repaired.

Intelligent Technology Technical Specifications

Definitions

- ADA Americans With Disabilities Act of 1991, and all subsequent amendments and regulations thereto.
- APC Automated Passenger Counter (**APC**)
- AVA Automatic Vehicle Annunciation system
- AVC Automatic Volume Control
- AVL Automatic Vehicle Locator
- DDU Driver Display Unit
- EEC Electronic Equipment Compartment
- LAN, WLAN Local Area Network, Wireless Local Area Network
- LDM Load Dump Module
- MAR Mobile Access Router
- MDC Mobile Data Computer
- MTD Mobile Data Terminal
- MTU Memory Transfer Unit (synonymous with MTC)
- MTC Memory Transfer Card (synonymous with MTU)
- PA Public Address System
- TSP Transit Signal Priority system
- VLU Vehicle Logic Unit

Technical Specifications

1. Public Address System

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

1.1 VLU Specifications

- a. 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.
- b. 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.
- c. The VLU shall be capable of integrating with sign/camera systems to support security setups such as CCTV.
- d. 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.
- e. The VLU system functionalities shall include but not be limited to AVA (Automatic Vehicle Annunciation), 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.

- f. 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:

1.2. Function and Design

- Single point logon
- 12 Year design life
- Real time voice & data communications
- Smart bus technology
- Replaceable and upgradeable solid-state storage
- Support for full color LCD touchscreen 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

1.3 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

- 1.4 Option: An option shall be available for Clever Devices SpeakEasy system, including driver's control head, floor switch, internal and external switches.

1.5 Passenger Information

- a. 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.
- b. 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.
- c. 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.
- d. 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 timepoint, route, and route variation in the system.
- e. The AVA system shall include at a minimum:

Automatic and operator defined annunciation control: Enables announcements based on trigger controlled parameters. Operator/manual override 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*, *Hanover*, *Balios*, *Sunrise*, or approved equal.

Automatic annunciation updates: Secure wireless bulk data transfer system via 802.11 WLAN system for automatic file download to the fleet.

1.6 Interior Next Stop Announcement

- a. 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 falls within the configured distance of the present stop enroute 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.
- b. 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.
- c. 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.

1.7 Interior Public Service Automatic or Operator-Initiated Announcement

- a. 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.
- b. 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.
- c. 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.
- d. The AVA system shall provide the capability for Automatic or Scheduled public service messages without Operator Intervention. DTA 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.

1.8 Exterior Route and Destination

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

1.9 Announcement Priority

- a. 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 DTA shall have the ability to change the priority using the server system.

1.10 Inside Signage

- a. 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.

1.11 Automatic Volume Control

- a. 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.
- b. 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.

1.12 Automatic Passenger Counter Installation/Integration

- a. 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.
- b. 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.

1.13 Data Communication

- a. 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 (we currently do not have this, we currently upload the data once the vehicle pulls in, it currently just picks up where it left off).
- b. 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.

1.14 Voice Communication

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

2. Automatic Vehicle Locator (AVL) System

- a. Contractor shall supply and install a fully functional Automatic Vehicle Locator. Parts list is as follows:

25T0422-002 24T0782-001 75T1199-025	Sierra MP70 FirstNet Ready Cellular, Passenger WIFI, and WLAN cellular modem and applicable cabling
10T0014-001	SIGN, 1-LINE ADAPTIVE
10T0519-001	V8 IVLU Assembly
45T0190-002	Radio, altered, TAIT, TM9355, 450-520
24T0016-001	Covert Mic
24T0028-003	Antenna, Radio, 450-520 MHz
24T0058-001	COVERT SWITCH
24T0486-002	ANTENNA, DUAL-BAND, GPS / WLAN
25T0128-104	HANDSET, 48" ARMORED
50T0035-001	J1708 DISTRIBUTION BOX
50T0056-001	Relay Assembly
50T0120-001	MDT Touch, 10.2+Color, W / Panavision
61T0384-005	Mount, MDT 5"
61T0773-001	MOUNT, HANDSET
75T0016-005	CABLE, MDT, LVDS, 5M
75T0169-025	Cable, RF, Mini UHF to PL 259, 25 FT
75T0321-011	Cable, Extension, J1708, 10 FT
75T0321-012	Cable, Extension, J1708, 30 FT
75T0417-025	CABLE, J1708 BOX TO FARE BOX, 25 FT
75T0462-001	Cable, Ext, J1708 to Hanover Destination Sign

75T0793-025	CABLE, GPS, FAKRA CONN, 25 FT
75T0793-125	CABLE, WLAN, FAKRA CONN, 25 FT
75T0955-001	CABLE, HARNESS, V8 IVLU, POWER
75T1114-001	CABLE, HARNESS, W1B, V8 IVLU
Trapeze APC (list below)	
50T0134-001	Receiver Assembly, TransitMaster APC
50T0135-001	Transmitter Assembly, TransitMaster APC
75T0756-001	Cable, Harness, Junction, TransitMaster APC, with J4
75T0756-002	Cable, Harness, Junction, TransitMaster APC, Without J4
75T0763-001	Cable, Harness, TransitMaster APC, Receiver, OEM
75T0763-002	Cable, Harness, TransitMaster APC, Transmitter, OEM
75T0763-003	Cable, Harness, TransitMaster APC, Receiver, OEM
75T0763-004	Cable, Harness, TransitMaster APC, Transmitter, OEM
75T1527-001	Cable, Harness, W2 V8 IVLU Power, 1-Radio
75T1529-001	CABLE, HARNESS, W1A, V88I IVLU, OEM or equal
50T0134-001	Receiver Assembly, TransitMaster APC
50T0135-001	Transmitter Assembly, TransitMaster APC

3. Electronic Equipment Compartment (EEC)

3.1 Each bus shall be equipped with a fully lit and sealed compartment located on the left front wheelhouse to provide a mounting location for a radio transceiver, security camera digital video recorder, onboard systems equipment and other electronic equipment. The compartment shall contain a combination of slide out shelves and a 19-inch rack, capable of height adjustment. Shelves shall securely latch in the stowed position. Provide an easily removable locking bar to retain the slide-out shelves in the stowed position. The compartment shall be rattle-free loaded or unloaded.

3.2 The compartment shall be equipped with a power supply per section C6.03.02.05, and shall be a minimum 32.5 inches high by 15 inches wide by 19.5 inches deep. The compartment shall be sealed against the entry of water, and equipped with a door, retained with a key lock. Supply approved interchangeable equal cores and keys to match the DTA's existing system. The DTA shall approve the box design, shelves, and power supplies.

3.3 Destination Signs

3.3.1. General. An automatic electronic destination sign system manufactured by *Hanover* that interfaces with the MDT shall be provided on each bus. A side destination sign shall be provided, as well as a remote emergency switch shall be provided that will display an emergency message on the exterior of the vehicle. The message will not appear on the driver's message monitor. The switch will be mounted on the driver's control panel and not on the floor area. Controls will be reachable by a seated driver. The route names will be expanded by not more than 10 entries from the current configuration. The colors of the signs will be yellow dots on black background. The glass in front of the destination sign shall be heated and the compartment shall be ventilated (fans required) so as to prevent fogging in cold weather.

a. Front Sign

The front destination sign shall be in a 16 by 160-matrix configuration, with a display dimension of 8.01 inches (20.3 cm) high by 64.6 inches (164 cm) wide. The front sign will be located as close to the sign box glass as possible and the installation shall be designed to minimize glare and maximize readability. The Contractor and the sign manufacturer shall jointly engineer the installation of the sign into the bus as an

integral component. Evidence of sign manufacturer's installation signoff shall be made available to the DTA.

b. Side Sign

The side destination sign shall be an 8x96 matrix with display dimensions of 2.8 inches (7.1 cm) high by 36.3 inches (92.2 cm) wide and be sufficiently compact so as to fit neatly in the side window. It shall be located on the right (curb) side of the bus in the top of the second window behind the front door.

c. Rear Sign and Street Side Sign

Provide 16x48 matrix signs in the rear of the bus and in the top of the front street side window behind the driver's barrier. If the top of the front street side window (behind the driver's barrier) is unavailable for sign placement, then place the sign in the top of the next window back.

d. Sign Control

Signs shall be controlled from the driver's station using a back-lit keypad. This control / display unit shall be used to view and update display messages. It shall be recess mounted on the front sign box door or above the driver's side window. The control shall utilize a conductive rubber pad keyboard with tactile feel and be designed to withstand the bus environment.

The control shall contain a two line by 20-character display. This system shall inform the driver on the status of the sign system. It shall contain an audio annunciator that beeps to alert the operator to view the display for a message, or beeps indicating that a key is depressed.

The control shall allow two destination messages to be pre-selected. The driver shall be able to quickly change the pre-selected message without re-entering the message code. Additionally, the control unit shall be able to access diagnostic functions and display corresponding results relative to sign maintenance.

Up to four-digit route numbers shall be selectable by the driver and shall be independent from the destination sign message. Leading zeroes shall not be displayed. The system shall have the additional ability to sequentially display multi-line destination messages, but with the route number portion remaining stable in a constant 'on' mode at all times.

Sign readings shall also be controllable without driver intervention via AVL information using a J1708 interface or via the DDU.

e. Sign Features

No blank messages shall be shown during a message sequence unless specifically programmed. Sequential messages shall be displayed in a manner and at a rate that makes it easy to read and comprehend the complete reading. Readings shall be stored in electronic memory on plug-in circuit boards. The message displays shall not be adversely affected by continued exposure to sunlight or other environmental conditions normally associated with bus operation. The system shall incorporate an auto-blanking feature that will cause the entire display area to be blank (black) within 30 seconds after the vehicle master power switch is turned off.

f. Sign Electronics

Each sign system shall have a system processor board, mounted in the front destination sign, capable of controlling up to 10 components. The system shall be capable of operating additional information displays or signs, such as interior information signs, as a future expansion possibility.

The system shall be designed so that the destination signs can display independent messages or the same message, as chosen by the message programmer during creation of the message listing.

There shall be the capability of storing at least 10,000 message lines with a capability of increasing this amount to at least 12,000 message lines. The sign memory shall be programmed with listing codes supplied by the DTA prior to delivery. There shall be no public relations messages programmed into the system.

g. Sign Programming

The sign system shall be re-programmable on the coach with the use of a Memory Transfer Unit (MTU) or Memory Transfer Card (MTC). A wireless option must be provided.

A list of destination sign readings will be supplied to the manufacturer to allow the signs to be preprogrammed with the correct readings.

Destination sign power will be supplied in all settings of the Master Run Switch except ENGINE STOP/OFF.

h. Component Quality

Electronic circuit boards shall be of a quality to facilitate repeated repair cycles. All I.C. sockets shall be machined pin, plated with a noble metal, preferably gold. All connectors, including I.C. sockets and board edge connectors shall be plated with a noble metal, preferably gold. Boards shall be mounted to reduce vibrational stress. The system shall operate at a nominal input voltage of 24 Vdc (+/- 6 Vdc). The sign system shall be internally protected against voltage transients and/or R.F. interference. Sufficient transient interference suppression will be included so the system will withstand transient pulses of 600 V for 10 microseconds and 100 V for 10 milliseconds. Sign interface cabling shall be shielded throughout the coach.

i. Visibility

The signs shall be visible and legible to a 5 foot 3 inch (160 cm) tall person standing as described below. Front and rear signs: 3 feet (914 mm) from the front (rear) of the bus and 1 foot (305 mm) from the side. Side sign: directly in front of the sign and 1 foot (305 mm) away from the side of the bus.

These are minimum requirements; the signs shall also be visible at greater distances.

Characters on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10, with a minimum character height (using an upper case 'X') of 1 inch (25 mm) for signs on the boarding side and a minimum character height of 2 inches (51 mm) for front 'head signs', with 'wide' spacing (generally, the space between letters shall be 1/16 the height of upper case letters), and shall contrast with the background, either dark-on-light or light-on-dark.

3.3.2 Sign Lighting and Boxes

a. The LED intensity automatically adjusts to the ambient light. Special attention will be given to using and mounting LEDs that will not fail due to vibrational stress when the coach is used in normal revenue service.

b. Sign mechanisms and boxes shall be constructed of materials designed to minimize static build-up and subsequent dirt accumulation. The front and rear destination sign cavities shall be sealed to prohibit the entry of dirt, dust, water and insects during normal revenue service or when coach interior is cleaned with a cyclone-type cleaner.

Sign boxes shall not vibrate or rattle and shall be sealed to exclude dirt, dust, water and insects. Each sign shall be housed in a protective cover that is removable with the sign.

A means shall be provided on the side sign to prevent accumulation of dirt on the inside of the bus window or on the outside of the sign box window. Heated front sign glass shall be supplied. Signs shall be visible at all times with no fogging of any glass.

c. Sign boxes shall have access doors to allow replacement of sign mechanisms and to allow servicing and cleaning. The front sign compartment access door shall have quarter turn adjustable spring latches with handles. The front sign compartment access door shall have a metallic piano hinge running the entire width of the access door; if bottom hinged, provide appropriate retaining straps. No components shall need to be removed to allow full opening of the sign door. The sign is removed and installed through this door unless the DTA agrees to other methods.

The rear and street side sign compartment access doors shall have quarter turn adjustable spring latches. These latches shall have slotted heads requiring the use of a screwdriver to open the access door. The rear and street side sign compartment access doors shall be hinged at the bottom by metallic piano hinge running the entire width of the access door.

d. Front and rear exterior sign glass (defined as the glass attached to the coach body) shall be masked to keep sign wiring and other compartment items hidden from view. Sign visibility shall not be affected with masking installed. Material used shall be black. Installation, visibility and type of material used will require approval of the DTA.

3.4 Communication Antennas

a. All buses shall be equipped with the following antennas. Placement of the antennas shall not interfere with numbers painted on the roof. Unpainted antennas are mounted with rivnuts and machine screws, with installation to be approved by the DTA. If the bus does not have a metal roof, suitable ground planes, to be approved by the DTA, shall be installed. Antennas shall be mounted in the center of their ground planes. All antenna provisions shall be approved by the DTA.

New Flyer is approved to supply 5/8-inch inside diameter plastic conduit from radio compartment to the driver's area and 0.56 inches inside diameter plastic conduit for antenna.

3.5 Radio

All buses shall come equipped with the TRS radio antenna-mounting top hat with 13+ground plane as well as the TRS RF connectors, mounting hardware and RF antenna.

3.6 GPS

a. In addition to the TRS antenna is a *Mobile Mark* SM1575 GPS antenna. This antenna will be located on the roof at the front of the bus, have an unobstructed view for satellites reception and not interfere with other communication devices. The cable, CAB-0000030640140050, will run from the GPS location to the equipment box with three feet of cable coiled at non-terminated ends.

b. Mobile Access Router (MAR)

Provide a *Mobile Mark, Inc.* model RM3-4900-9C-blk-180 or approved equal antenna with the cable leading into the EEC and ending in a 3-foot coil of extra length. This antenna shall be mounted near the front edge of the roof.

c. Antenna lead-in cables, unless otherwise noted, shall be changed to CNT-240 *Andrew* or approved equal coaxial cable connecting each antenna with the electronic equipment compartment. Provide 3 feet (914 mm) of excess cable at each end. The antenna cables shall be routed through continuous 0.75-inch (19 mm) rigid thin wall metallic conduit or nylon tubing installed to allow easy replacement of the wire and prevent rubbing and chafing. All connectors shall be installed; supply and install coaxial cable connectors. An interior ceiling access panel must be supplied directly under antenna. The antenna must be installed to not interfere with the roof top vehicle identification numbers.

d. Access covers, painted to match the adjacent ceiling panels, shall be supplied on the interior ceiling allowing access to the antennas. Mounting of these covers will be with rivnut and machine screws. A metal backing plate shall be used.

e. Provide an *Amtech* model AT5704 or approved equal transit signal priority tag in the upper front curbside corner of the front of the bus.

f. Static Ground A method of grounding static electricity shall be provided on each bus and will be approved at the design review.

3.7 Passenger Signal

a. General

The main function of the chime signal systems is to enable any mobile passenger to inform the driver and the other passengers that the bus is requested to stop at the next bus stop (system A) and to alert the driver that a mobility aid passenger wishes to disembark (system B). These systems shall alert the driver,

both visually and audibly, and separately from each other. The Contractor may propose integrated or separate system(s) that accomplish this. The DTA shall approve the design, position, materials and operation of both passenger signal systems.

1. System A

The purpose of this system is to request stops and to alert the driver that a fully mobile passenger wishes to disembark. One solid-state electronic chime signal shall be provided. A separate light signal shall be provided on the driver's instrument panel and shall illuminate when the system is activated. Two lighted display signs, one single-sided at the rear of the driver's barrier, and one single-sided opposite the rear door, shall be mounted near the centerline on the ceiling.

System A signals shall be actuated by wire-centered yellow plastic cords running horizontally for the full length of each side of the bus except at door openings. These cords shall be located along the imaginary line separating the upper bin windows from the lower sections of the side windows, and shall not interfere with opening of the side destination sign and route number sign for inspection. If the cord is not usable in the rear door area, a button to actuate the signal shall be placed on a nearby stanchion. Vertical drop cords shall be located at every side window pillar. These cords shall be secured to the horizontal chime cord with tiller clamps so they will not slide or travel. They shall be anchored at the opposite (bottom) end by means of an eyelet attached to the bus sidewall, and secured with a tiller clamp. Use dual half-shell Atwood Corp. tiller clamps, p.n. 8043-3 or approved equal with Torx screws at each chime cord crimp location. Cords shall not interfere with any window operation.

When system A is actuated by a passenger, chime shall sound, the passenger display signs shall be illuminated and the driver's dash mounted lamp shall illuminate. The chime shall be disabled while the displays are on. When any door is opened, the displays shall be on with the chime disabled. After all doors close, the system shall be reset.

2. System B

This system shall allow a mobility aid user to request a stop and alert the driver that he/she wishes to disembark. One solid-state electronic chime signal shall be provided. This chime shall produce a different sound than the system A chime. A separate light signal shall be provided on the driver's instrument panel and shall illuminate when the system is activated. Activation of this system shall illuminate the two lighted display signs referenced in section C3.04.02 (system A).

Controls for system B shall be mounted no higher than 48 inches (1219 mm) and no lower than 15 inches (381 mm) above the floor, shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall be no greater than 5 lb. (22.2 N). Provide a touch pad on the bottom of the two-passenger folding seat in each tie down location. This touch pad shall be located where it will not be accidentally activated by movement of the secured mobility aid device. The flip-up seats with the touch pads shall have an electrical disconnect plug to facilitate removal of the flip-up seat for maintenance. Plug to be accessible to maintenance and not visible to passengers.

When any tie down area stop request signal is activated, the system B chime shall sound and the driver's dash mounted lamp shall illuminate. The chime shall be disabled while the display is on. When any door is opened, the display shall be on with the chime disabled. After all doors close, the system shall be reset.

3.8 Public Address System/OBS Provisions

a. Public address system provisions shall be provided on each bus for facilitating radio system and driver-originated announcements to passengers. The PA system uses the radio transceiver or other equipment as an amplifier. Contractor-supplied components shall not contribute distortion or low voltage noise interference and shall produce a clean, clear sound. The DTA at the design review shall approve the equipment and the locations of the PA system components.

b. At least 6 interior loudspeakers shall be provided, semi-flush overhead mounted, on alternate sides of the bus passenger compartment, installed with proper phasing. The interior speakers shall be split into two zones of at least 3 speakers each for the current On-Board System PA function. These zones shall divide the bus into a front half and a rear half. Total impedance for each zone seen at the input connecting end shall be 4 to 8 ohms. Mounting shall be accomplished with rivnuts, machine screws and utilize a metal

backing plate. One exterior speaker, of weatherproof design, shall be provided on the curbside no more than 1 foot from the front door. The wire for this speaker shall be routed to the EEC. Speakers shall be installed so as to facilitate testing and replacement when necessary.

3.9 Automatic Passenger Counter Provisions

- a. The bus will have an infrared Automatic Passenger Counter (APC) TMAPC system.
- b. Provide mounting space within each doorway, either above or on both sides, depending on doorway width, direction doors open and space to mount the APC Analyzer. APC mount location will be approved by DTA prior to manufacture.

3.10 The following visual indicators shall be provided, augmented as shown below with audible warnings. Indicators may be located on the instrument panel or other approved location. The audible alarm buzzer shall be noticeable to the driver, but not at a sound level or pitch that is objectionable. Audible alarms shall be electronic.

Condition	Telltale Alarm	Lamp Text or Symbol	Color
Rear door open	None	EXIT DOOR	Red
Air brake application (not retarder)	None	STOP LAMP	Red
Headlight high beam	None	Symbol	Blue
Low air pressure	Buzzer	LOW AIR	Red
High propulsion system temp.	Buzzer	SYSTEM HOT	Red
High EV Drive Unit temp.	Buzzer	DRIVE HOT	Red
Turn indicator, R	None	Symbol	Green
Turn indicator, L	None	Symbol	Green
Emergency flashers	Tone	Symbol	Green
Parking brake on	None	PARK BRAKE	Red
DC/DC converter not charging	Buzzer	DISCHARGE	Red
Passenger stop	Chime 1	PASS STOP	Yellow
Mobility aid user stop	Chime 2	(International Wheelchair Symbol)	Yellow
Propulsion system fire alarm	Buzzer	ENGINE FIRE	Red
Rear door interlock off	Buzzer	WARNING INTERLOCK Deactivated	Red
Ramp enabled	None	RAMP	Red
ABS failure	None	ANTI-LOCK	Red
ATC failure	None	TRACTION CONTROL	Yellow
Rear door sensitive edge	Buzzer	DOOR ALARM	Red
Propulsion system status	Light	MANUFACTURER TO DECIDE	Red/Yellow

3.11 Radio Handset and Control System Provisions

- a. Where noted, the Contractor shall be responsible to design mounting provisions for the radio handset, driver display unit (DDU) plus its active cradle and radio transceiver. The Contractor shall supply and install all components noted in this section unless otherwise indicated.

The locations and mounting arrangements for components referenced in this section shall be reviewed by the DTA at the design review.

b. Each bus shall have a recessed speaker in the ceiling panel above the driver. This speaker shall be the same component used for the speakers in the passenger compartment. It shall have 4 ohms of impedance. It shall be painted the same color as the surrounding area. Mounting shall be accomplished with rivnuts, machine screws and utilize a metal backing plate.

c. Handset

Each bus shall have provision for mounting a radio handset on the right side of the dashboard convenient to the driver. It is preferred that the bracket be mounted on a horizontal plane. Pay particular attention to mounting the handset and the driver's microphone to prevent interference.

3.12 Driver Display Unit

a. Each bus shall have provision for mounting a Driver Display Unit (DDU) and its active cradle as close to the right side of the instrument panel as possible. The DDU and its bracket are supported on a Contractor-supplied RAM Mount Systems model 101 or approved equal double-ball adjustable clamp. The RAM mount must be attached to bus structure by means of Contractor-supplied bracket(s) and reinforcing plate(s). Attachment solely to the dashboard or instrument panel sheet metal or FRP is prohibited. The DTA will select the style and length of the RAM mount clamp depending on the design of the Contractor's bus and the final location of the DDU. The mounting location and RAM mount clamp will allow all drivers defined in Section C4.01 to easily reach the DDU.

b. Provide conduit and fittings by ~~Adaptaflex~~ or approved equal to carry harnesses from the DDU active cradle. The conduit carries a harness to the under-dash area, where it will split off to a power supply and Ethernet communications. The ~~Adaptaflex~~ conduit is part no. PAFS16/BL/50M, and the ~~Adaptaflex~~ fittings are part no. AL16/M20/A.

3.13 Emergency Alarm

Provide and install an emergency covert alarm, including associated programming, to activate an emergency radio alarm at dispatch and permits covert microphone. Alarm button shall be Otto Engineering, part #21649 or approved equal, located on the side console next to the driver's seat, in a location to approved by the DTA prior to manufacture.

3.14 Cable Installation

Provide and install the following wiring, leaving an extra three-foot coil at locations outside the electronic equipment cabinet (EEC), and a five-foot coil for wiring at the EEC end. Label each end of the wire with the W+numbers. The DTA will supply and install the connectors.

- **W1** DDU location to the EEC . Alpha 2461C or approved equal.
- **W2** P.A. speakers to the EEC . Belden 8761 2 core or approved equal.
- **W3** Handset location to the EEC . Alpha 1296C 6 core or approved equal.
- **W4** Emergency alarm switch location to the EEC . Belden 8761 2 core or approved equal.
- **W5** EEC to the Tag Interface Unit location (in sign compartment) . Carol E2004S 4 core or approved equal.
- **W6** Camera activation switch location to the EEC . Belden 8761 2 core or approved equal.
- **W7** P.A. microphone receptacle to the EEC . Belden 8761 2 core or approved equal.
- **W8** Driver's speaker to the EEC . Belden 8761 2 core or approved equal.
- **W9** P.A. aux. microphone receptacle to the EEC . Belden 8761 2 core or approved equal.
- **W10** Exterior speaker to the EEC . Belden 8761 2 core or approved equal.

The DTA will work with the Contractor to determine equipment locations.

Section 4 General Electronic Requirements

4.1. a If an electronic component has an internal clock, it shall provide its own battery backup to monitor time when battery power is disconnected. Any component with its own real-time clock will be set to Central Standard Time.

All electronic component suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling, and also in over-voltage and reverse polarity conditions. If an electronic component is required to interface with other components, it shall not require external pull-up and/or pull-down resistors without prior approval of the DTA.

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

b. Discrete I/O (Inputs/Outputs)

All wiring to I/O devices, either at the harness level or individual wires, shall be labeled, stamped or color-coded in a fashion that allows unique identification. Labels shall be resistant to rubbing (hot stamped tubing and protected printing are service-proven examples of acceptable labels). Wiring for each I/O device shall be bundled together. If the I/O terminals are the same voltages, then jumpers may be used to connect the common of each I/O terminal.

c. Shielding

All wiring that requires shielding shall meet the following minimum requirements. A shield shall be generated by connecting to a ground, which is sourced from a power distribution bus bar or chassis. A shield shall be connected at one location only, typically at one end of the cable. However, certain standards or special requirements, such as SAE J1939 or RF applications, have separate shielding techniques that shall also be used as applicable. *Note: A shield grounded at both ends forms a ground loop, which can cause intermittent control or faults.* When using shielded or coaxial cable, upon stripping of the insulation, the metallic braid shall be free from frayed strands, which can penetrate the insulation of the inner wires. To prevent the introduction of noise, the shield shall not be connected to the common side of a logic circuit.

d. Communications

The data network cabling shall be selected and installed according to the selected protocol requirements. The physical layer of all network communication systems shall not be used for any other purpose other than communication between the system components, unless provided for in the network specifications. Communications networks that use power line carriers (e.g. data modulated on a 24 V-power line) shall meet the most stringent applicable wiring and terminal specifications.

e. Radio Frequency (RF)

RF components, such as radios, video devices, cameras, global positioning systems (GPS), etc., shall use coaxial cable to carry the signal. All RF systems require special design consideration for losses along the cable. Connectors shall be minimized, since each connector and crimp has a loss, which will contribute to attenuation of the signal. Cabling should allow for the removal of antennas or attached electronics without removing the installed cable between them. The corresponding component vendors shall be consulted for proper application of equipment including installation of cables.

f. Audio

Cabling used for microphone level and line level signals shall be 22 AWG minimum with shielded twisted pair and with drain wire. Cabling used for amplifier level signals shall be 18 AWG minimum.

4.2 Multiplexing

a. General

All vehicles shall be equipped with a multiplexing system. The primary purpose of the multiplexing system is control of components necessary to operate the vehicle. This is accomplished by processing information from input devices and controlling output devices through the use of an internal logic program. This system shall meet the network communications requirements of DTA IT Specifications. The DTA shall approve the multiplex system.

Versatility and future expansion shall be provided for by an expandable system architecture. The multiplex system shall be capable of accepting new inputs and outputs through the addition of new modules and/or the utilization of the spare inputs and outputs provided on each module. All like components in the multiplex system shall be modular and interchangeable with self-diagnostic capabilities. The modules shall be easily accessible for troubleshooting electrical failures and performing system maintenance. Multiplex

input/output modules shall use solid-state devices to provide extended service life and individual circuit protection.

Ten percent (10%) of the total number of inputs and outputs (or at least one each) at each zone location shall be designated as spares. Zone locations are: (1) behind the rear bulkhead; (2) forward of the bulkhead above the window line; and (3) forward of the bulkhead below the window line.

b. System Configuration

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

c. I/O (Input/Output) Signals

The input/output for the multiplex system may contain three types of electrical signals: discrete, analog, or serial data.

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

4.3 Data Communications Systems

a. General

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

1. Protocol requirements for all timing issues (bit, byte, packet, inter-packet timing, idle line timing, etc.) packet sizes, error checking, and transport (bulk transfer of data to/from the device).
2. Data definition requirements that ensure access to diagnostic information and performance characteristics.
3. The capability and procedures for uploading new application or configuration data.
4. Access to revision levels of data, application software and firmware.
5. The capability and procedures for uploading new firmware or application software.

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

All components on the Drive Train network shall communicate data over the network as specified in Section C6.03.05.02. The Multiplex Level shall use a communications network that meets the requirements of Section C6.03.05.03. Components integrated on the Information Level shall communicate data over the network selected in Section C6.03.05.04.

4.4 Multiplex Level

a. Data Access

At a minimum, information shall be made available via a communication port on the multiplex system. The location of the communication port shall be easily accessible.

Provide a 12 Vdc power outlet adjacent to each diagnostic port on the interior of the vehicle. The DTA will approve the exact location(s).

b. Diagnostics And Fault Detection

The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (Online) or inactive (Offline) faults through the use of on-board visual/audible indicators.

In addition to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer (PC) or a handheld unit. Either unit shall have the ability to check logic function.

c. Programmability (Software)

The multiplex system shall have security provisions to protect its software from unwanted changes. This shall be achieved through any or all of the following procedures: password protection, limited distribution of the configuration software, limited access to the programming tools required to change the software, and hardware protection that prevents undesired changes to the software.

Provisions for programming the multiplex system shall be possible through a PC/laptop. The multiplex system shall have proper revision control to ensure that the hardware and software is identical on each vehicle equipped with the system. Revision control shall be provided by all of the following: hardware component identification where labels are included on all multiplex hardware to identify components; hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module; and software revision identification where all copies of the software in service displays the most recent revision number, and a method of determining which version of the software is currently in use in the multiplex system.

The bus builder will work with the DTA to provide all requested changes free of charge during the full bus warranty period. Change requests to the software will be provided in a timely manner. The DTA requests to have full programming access to the multiplex system. When legal liability concerns preclude such access, the vendor will provide the DTA with a list of EPROM parameters and place a copy of all software revisions in escrow giving the DTA access in case of vendor default.

4.5 Fare boxes

- a. Provide all connections for ~~GF~~Fast Fare electronic fare boxes. DTA to install the fareboxes.

4.6 Camera Surveillance System

Provide and install a complete operating and tested on-board IP video surveillance system from TSI. The system will include a RR-MRH8 digital video recorder (DVR) with internal heater option, eight (8) IP cameras with audio, license-free operating software, and all necessary interconnecting cables, wiring harnesses, mounting brackets, and miscellaneous hardware. The system will have the capability to connect via Ethernet to wireless communication devices for the purposes of system maintenance and access by first responders and police. Provide a 12VDC battery circuit to the DVR main power and a switched 12 VDC circuit to the DVR to be used as a ~~RUN~~signal only.

Mount the cameras as shown in the DTA Order form. Mount the DVR on the top shelf of the Electronic Equipment Cabinet.

- b. Camera system part list:

TSI PART #	DESCRIPTION	QTY PER BUS
NEX-HVR	TSI Nexus-HVR Hybrid Video Recorder (without switch)	1
NSW-8PT-KIT	TSI 8 port PoE Switch Kit	1
HDD-NEX-4TB	TSI Nexus-HVR 4TB HDD (with failover capability)	1
NEX-PWR-DIS-002	TSI Power Distribution Harness For Nexus-HVR With IP Cameras	1
TSIP-07	TSI Slim Line IR Wedge 3MP IP Camera [Internal With Mics]	6
TSIP-08	TSI Slim Line IR Wedge 3MP IP Camera [External Cameras]	2
BRK-UNIV-MNT	TSI Universal Front Camera Mount	1
ACC-00002	TSI LED Status For Nexus-HVR	1
ACC-00005-V2	TSI Event Button/Switch With Connector	1
WLS-00301	TSI 802.11n Wireless AP	1
WLS-00302	TSI 802.11n Wireless Antenna	1
WLS-00303	TSI 802.11n AP Bracket	1
ACC-03-RJ45	TSI Garmin GPS Receiver/Antenna	1
TBD	TSI cable harness for 8 camera Duluth DTA equipment set shown above	1

4.4 Transit Signal Priority System

Provide and install an Opticom Transit Signal Priority Multimode Emitter, Low Priority, Model 794TM, part number 76-1000-1147-0, in accordance with these specifications and manufacturer's instructions.

Provide and install a Tyco Electronics Relay, part number 1432793-1.

Emitter shall be located in the top of the bus (exterior) upper right front corner of the bus. Cable path shall be approved by the DTA.

Vendor Part Number	Description	Quantity
76-1000-1156-0 (kit)	Radio GPS Control Unit Low Priority	1
76-1000-1156-0 (kit)	Radio GPS Antenna and cable	1
76-1000-1156-0 (kit)	Opticom, 210 Vehicle Interface Harness (J1708)	1
76-1000-1047-0	Model 794T, Opticom Strobe Low Priority Emitter	1
1432793-1	Tyco Electronics Relay (not available through Opticom)	1
76-1000-1242-0	Vehicle Interface Cable	1