

<b>SECTION 3</b>
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**SECTION 3 CONTRACTOR'S IN-PLANT QUALITY ASSURANCE REQUIREMENTS****3.0 QUALITY ASSURANCE REQUIREMENTS**

The Contractor, the Contractor's manufacturing plant and organization shall be certified to the appropriate QS-9000/ISO 9000 series of standards.

**3.1 QUALITY ASSURANCE ORGANIZATION ESTABLISHMENT**

The Contractor shall establish and maintain an effective in-plant quality assurance organization. It shall be a specifically defined organization and should be directly responsible to the Contractor's top management.

**3.2 CONTROL**

The quality assurance organization shall exercise quality control over all phases of production from initiation of design through manufacture and preparation for delivery. The organization shall also control the quality of supplied articles.

**3.3 AUTHORITY AND RESPONSIBILITY**

The quality assurance organization shall have the authority and responsibility for reliability, quality control, inspection planning, establishment of the quality control system, and acceptance/rejection of materials and manufactured articles in the production of the transit buses.

**3.4 QUALITY ASSURANCE ORGANIZATION FUNCTIONS**

The quality assurance organization shall include the following minimum functions.

**3.5 WORK INSTRUCTIONS**

The quality assurance organization shall verify inspection operation instructions to ascertain that the manufactured product meets all prescribed requirements.

**3.6 RECORDS MAINTENANCE**

The quality assurance organization shall maintain and use records and data essential to the effective operation of its program. These records and data shall be available for review by the Resident Inspectors. Inspection and test records for this procurement shall be available for a minimum of one (1) year after inspections and tests are completed.

**3.7 CORRECTIVE ACTION**

The quality assurance organization shall detect and promptly assure correction of any conditions that may result in the production of defective transit buses. These conditions may occur in designs, purchases, manufacture, tests, or operations that culminate in defective supplies, services, facilities, technical data, or standards.

**3.8 BASIC STANDARDS AND FACILITIES**

The following standards and facilities shall be basic in the quality assurance process.

**3.9 CONFIGURATION CONTROL**

The Contractor shall maintain drawings, assembly procedures, and other documentation that completely describe a qualified bus that meets all of the options and special requirements of this procurement. The quality assurance organization shall verify that each transit bus is manufactured in accordance with these controlled drawings, procedures, and documentation.

**3.10 MEASURING AND TESTING FACILITIES**

The Contractor shall provide and maintain the necessary gauges and other measuring and testing devices for use by the quality assurance organization to verify that the buses conform to all specification requirements. These devices shall be calibrated at established periods against certified measurement standards that have known, valid relationships to national standards.

**3.11 PRODUCTION TOOLING AS MEDIA OF INSPECTION**

When production jigs, fixtures, tooling masters, templates, patterns, and other devices are used as media of inspection, they shall be proved for accuracy at formally established intervals and adjusted, replaced, or repaired as required to maintain quality.

**3.12 EQUIPMENT USE BY RESIDENT INSPECTORS**

The Contractor's gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the Contractor's personnel shall be made available to operate the devices and to verify their condition and accuracy.

**3.13 CONTROL OF PURCHASES**

The Contractor shall maintain quality control of purchases.

**3.14 SUPPLIER CONTROL**

The Contractor shall require that each supplier maintains a quality control program for the services and supplies that it provides. The Contractor's quality assurance organization shall inspect and test materials provided by suppliers for conformance to specification requirements. Materials that have been inspected, tested, and approved shall be identified as acceptable to the point of use in the manufacturing or assembly processes. Controls shall be established to prevent inadvertent use of nonconforming materials.

**3.15 PURCHASING DATA**

The Contractor shall verify that all applicable specification requirements are properly included or referenced in purchase orders of articles to be used on transit buses.

**3.16 MANUFACTURING CONTROLLED CONDITIONS**

The Contractor shall ensure that all basic production operations, as well as all other processing and fabricating, are performed under controlled conditions. Establishment of these controlled conditions shall be based on the documented work instructions, adequate production equipment, and special working environments if necessary.

**3.17 COMPLETED ITEMS**

A system for final inspection and test of completed transit buses shall be provided by the quality assurance organization. It shall measure the overall quality of each completed bus.

**3.18 NONCONFORMING MATERIALS**

The quality assurance organization shall monitor the Contractor's system for controlling nonconforming materials. The system shall include procedures for identification, segregation, and disposition.

**3.19 STATISTICAL TECHNIQUES**

Statistical analysis, tests, and other quality control procedures may be used when appropriate in the quality assurance processes.

**3.20 INSPECTION STATUS**

A system shall be maintained by the quality assurance organization for identifying the inspection status of components and completed transit buses. Identification may include cards, tags, or other normal quality control devices.

**3.21 INSPECTION SYSTEM SCOPE**

The quality assurance organization shall establish, maintain, and periodically audit a fully-documented inspection system. The system shall prescribe inspection and test of materials, work in process, and completed articles. As a minimum, it shall include the following controls.

**3.22 INSPECTION PERSONNEL**

Sufficient trained inspectors shall be used to ensure that all materials, components, and assemblies are inspected for conformance with the qualified bus design.

**3.23 INSPECTION RECORDS**

Acceptance, rework, or rejection identification shall be attached to inspected articles. Articles that have been accepted as a result of approved materials review actions shall be identified. Articles that have been reworked to specified drawing configurations shall not require special identification. Articles rejected as unsuitable or scrap shall be plainly marked and controlled to prevent installation on the bus. Articles that become obsolete as a result of engineering changes or other actions shall be controlled to prevent unauthorized assembly or installation. Unusable articles shall be isolated and then scrapped.

Discrepancies noted by the Contractor or resident inspectors during assembly shall be entered by inspection personnel on a record that accompanies the major component, subassembly, assembly, or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures, or other conditions that cause articles to be in nonconformity with the requirements of the contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, the MTS shall approve the modification, repair, or method of correction to the extent that the contract specifications are affected.

**3.24 QUALITY ASSURANCE AUDITS**

The quality assurance organization shall establish and maintain a quality control audit program. Records of this program shall be subject to review by the MTS.

**3.25 INSPECTION STATIONS**

Inspection stations shall be at the best locations to provide for the work content and characteristics to be inspected. Stations shall provide the facilities and equipment to inspect structural, electrical, hydraulic, and other components and assemblies for compliance with the design requirements.

Stations shall also be at the best locations to inspect or test characteristics before they are concealed by subsequent fabrication or assembly operations. These locations shall minimally include underbody structure completion, body framing completion, body prior to paint preparation, water test before interior trim and insulation installation, engine installation completion, underbody dress-up and completion, bus prior to final paint touchup, bus prior to road test, and bus final road test completion.

### **3.26 RESIDENT INSPECTOR ROLE**

The MTS shall be represented at the Contractor's plant by resident inspectors. They shall monitor, in the Contractor's plant, the manufacture of transit buses built under the procurement. The presence of these resident inspectors in the plant shall not relieve the Contractor of its responsibility to meet all of the requirements of this procurement. The MTS shall designate a primary resident inspector, whose duties and responsibilities are delineated in "Pre-Production Meetings" (Section 3.27); "MTS" (Section 3.28); and "Pre-Delivery Tests" (Section 3.31). Contractor and resident inspector relations shall be governed by the guidelines included in this Section 3, "Quality Assurance" Provisions.

### **3.27 PRE-PRODUCTION MEETINGS**

The primary resident inspector shall participate in design review and pre-production meetings with the MTS. At these meetings the configuration of the buses and the manufacturing processes shall be finalized, and all contract documentation provided to the inspector.

No less than thirty (30) days prior to the beginning of bus manufacture, the primary resident inspector shall meet with the Contractor's quality assurance manager and shall conduct a pre-production audit meeting. They shall review the inspection procedures and finalize inspection checklists. The resident inspectors may begin monitoring bus construction activities two weeks prior to the start of bus fabrication.

### **3.28 MTS**

Records and data maintained by the quality assurance organization shall be available for review by the resident inspectors. Inspection and test records for this procurement shall be available for a minimum of one year after inspections and tests are completed.

The Contractor's gauges and other measuring and testing devices shall be made available for use by the resident inspectors to verify that the buses conform to all specification requirements. If necessary, the Contractor's personnel shall be made available to operate the devices and to verify their condition and accuracy.

Discrepancies noted by the resident inspector during assembly shall be entered by the Contractor's inspection personnel on a record that accompanies the major component, subassembly, assembly, or bus from start of assembly through final inspection. Actions shall be taken to correct discrepancies or deficiencies in the manufacturing processes, procedures, or other conditions that cause articles to be in nonconformity with the requirements of the contract specifications. The inspection personnel shall verify the corrective actions and mark the discrepancy record. If discrepancies cannot be corrected by replacing the nonconforming materials, the MTS shall approve the modification, repair, or method of correction to the extent that the contract specifications are affected.

The primary resident inspector shall remain in the Contractor's plant for the duration of bus assembly work under this contract. Only the primary resident inspector or designee shall be authorized to release the buses for delivery. The resident inspectors shall be authorized to approve the pre-delivery acceptance tests. Upon request to the quality assurance supervisors, the resident inspectors shall have access to the Contractor's quality assurance files related to this procurement. These files shall include drawings, assembly procedures, material standards, parts lists, inspection processing and reports, and records of defects.

### **3.29 SUPPORT PROVISIONS**

The Contractor shall provide office space for the resident inspectors in close proximity to the final assembly area. This office space shall be equipped with desks, outside and interplant telephones, high speed internet connection, drinking water, HVAC, file cabinet, chairs, and clothing lockers sufficient to accommodate the resident staff.

### **3.30 RESPONSIBILITY - ACCEPTANCE TESTS**

Fully-documented tests shall be conducted on each production bus following manufacture to determine its acceptance to the MTS. These acceptance tests shall include pre-delivery inspections and testing by the Contractor, and inspections and testing by the MTS after the buses have been delivered.

### **3.31 PRE-DELIVERY TESTS**

The Contractor shall conduct acceptance tests at its plant on each bus following completion of manufacture and before delivery to the MTS. These pre-delivery tests shall include visual and measured inspections, as well as testing the total bus operation. The tests shall be conducted and documented in accordance with written test plans, approved by the MTS.

Additional tests may be conducted at the Contractor's discretion to ensure that the completed buses have attained the desired quality and have met the requirements in "Technical Specifications" (Sections 5 and 6). The MTS may, prior to commencement of production, demand that the Contractor demonstrate compliance with any requirement in "Technical Specifications" (Sections 5 and 6), if there is evidence that prior tests have been invalidated by Contractor's change of supplier or change in manufacturing process. Such demonstration shall be by actual test, or by supplying a report of a previously performed test on similar or like components and configuration. Any additional testing shall be recorded on appropriate test forms provided by the Contractor and shall be conducted before acceptance of the bus.

The pre-delivery tests shall be scheduled and conducted with thirty (30) days notice so that they may be witnessed by the resident inspectors, who may accept or reject the results of the tests. The results of pre-delivery tests, and any other tests, shall be filed with the assembly inspection records for each bus. The under floor equipment shall be available for inspection by the resident inspectors, using a pit or bus hoist provided by the Contractor. A hoist, scaffold, or elevated platform shall be provided by the Contractor to easily and safely inspect bus roofs. Delivery of each bus shall require written authorization of the primary resident inspector. Authorization forms for the release of each bus for delivery shall be provided by the Contractor. An executed copy of the authorization shall accompany the delivery of each bus.

### **3.32 INSPECTION - VISUAL AND MEASURED**

Visual and measured inspections shall be conducted with the bus in a static condition. The purpose of the inspection testing is to verify overall dimensional and weight requirements, to verify that required components are included and are ready for operation, and to verify that components and subsystems that are designed to operate with the bus in a static condition do function as designed.

### **3.33 TOTAL BUS OPERATION**

Total bus operation shall be evaluated during road tests. The purpose of the road tests is to observe and verify the operation of the bus as a system and to verify the functional operation of the subsystems that can be operated only while the bus is in motion.

Each bus shall be driven for a minimum of fifteen (15) miles during the road tests. Observed defects shall be recorded on the test forms. The bus shall be retested when defects are corrected and adjustments are made. This process shall continue until defects or required adjustments are no longer detected. Results shall be pass/fail for these bus operation tests.

### **3.34 POST-DELIVERY TESTS**

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

Buses that fail to pass the post-delivery tests are subject to non-acceptance. MTS shall record details of all defects on the appropriate test forms and shall notify the Contractor of acceptance, conditional acceptance, or non-acceptance of each bus within five days according to "Acceptance of Bus" (Section 2.18) after completion of the tests. The defects detected during these tests shall be repaired according to procedures defined in "Contractual Provisions" (Section 2, "Repairs After Non-acceptance" (Section 2.20).

### 3.35 VISUAL INSPECTION

The post-delivery inspection is similar to the inspection at the Contractor's plant and shall be conducted with the bus in a static condition. Any visual delivery damage shall be identified and recorded during the visual inspection of each bus.

### 3.36 BUS OPERATION

Road tests will be used for total bus operation similar to those conducted at the Contractor's plant. In addition, the MTS may elect to perform chassis dynamometer tests. Operational deficiencies of each bus shall be identified and recorded.

### 3.37 GUIDE FOR INSPECTION

The "actual" acceptance inspection will be a basic visual/performance review which will be supplemented by requirements learned through the effort of reviewing the first article and the manufacturers recommended inspection guidelines. The basic inspection will consist of at least the following elements:

- ✓ Visual safety inspection
- ✓ Check/fill fluids
- ✓ Rubbing hoses
- ✓ Rubbing electrical cables
- ✓ Loose electrical connectors
- ✓ Use of approved clamps and fastening components
- ✓ Routing of electrical wires and harnesses
- ✓ Location and performance of installed components
- ✓ Check for leaks, plumbing routing/clamps
- ✓ Critical fastener torque
- ✓ Driving test, performance, shifting, steering
- ✓ Exterior water leak test
- ✓ Brake deceleration, retarder activation
- ✓ Data collection, VIN #, license, serial #'s

<b>SECTION 4</b>
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#### **4.0 BASIC PROVISIONS WARRANTY AND CONTRACTOR WARRANTY REQUIREMENTS**

Warranties in this document are in addition to any statutory remedies or warranties imposed on the Contractor. Consistent with this requirement, the Contractor warrants and guarantees to the original MTS each complete bus, and specific subsystems and components as follows.

##### **4.1. COMPLETE BUS**

The complete bus, propulsion system, components, major subsystems, and body and chassis structure, are warranted to be free from defects and related defects for two (2) years or 100,000 miles, whichever comes first, beginning on the date of acceptance, or conditional acceptance of each bus under "Acceptance of Bus" (2.18). The warranty is based on regular operation of the bus under the operating conditions prevailing in the MTS's locale.

##### **4.2 BODY AND CHASSIS STRUCTURE**

The body, body structure and structural elements of the suspension, such as the primary load carrying members of the bus structure, shall be warranted for the service life of the bus.

##### **4.3 PROPULSION SYSTEM**

Propulsion system components (fan to flywheel), specifically the engine, transmission and drive and non-drive axles shall be warranted to be free from defects and related defects for five (5) years or 300,000 miles, whichever comes first. Propulsion system manufacturer's standard warranty, delineating items excluded from this warranty, submitted in accordance with "Proposer Communications and Requests" (Section 1.4 of MTS's solicitation), is attached.

##### **4.4 MAJOR SUBSYSTEMS**

Major subsystems shall be warranted to be free from defects and related defects, for three (3) years or 150,000 miles, whichever comes first. Major subsystem manufacturers standard warranty, delineating items excluded from this warranty, submitted in accordance "Proposer Communications and Requests" (Section 1.4 of MTS's solicitation), is attached. Items included as Major Subsystems are listed below:

- Brake system
- Destination signs
- Heating, ventilating, and air conditioning system
- Door systems
- Air compressor and dryer
- Wheelchair lift and ramp system
- Starter alternator
- Fuel storage system

- Fire suppression system

#### **4.5 EXTENSION OF WARRANTY**

If, during the warranty period, repairs or modifications on any bus, made necessary by defective design, materials or workmanship are not completed due to lack of material or inability to provide the proper repair for thirty (30) calendar days, the applicable warranty period shall be extended by the number of days equal to the delay period.

#### **4.6 VOIDING OF WARRANTY**

The warranties shall not apply to the failure of any part or component of the bus that directly results from misuse, negligence, accident, or repairs not conducted in accordance with the Contractor provided maintenance manuals and with workmanship performed by adequately trained personnel in accordance with recognized standards of the industry. The warranty shall also be void if the MTS fails to conduct normal inspections and scheduled preventive maintenance procedures as recommended in the Contractor's maintenance manuals and that omission caused the part or component failure. MTS shall maintain documentation, auditable by the Contractor, verifying service activities in conformance with the Contractor's maintenance manuals.

#### **4.7 EXCEPTIONS AND ADDITIONS TO WARRANTY**

The warranties shall not apply to the following scheduled maintenance items, normal wear-out items, and items furnished by the MTS, except insofar as such equipment may be damaged by the failure of a part or component for which the Contractor is responsible.

The warranties shall not apply to components and major subsystems specified by the MTS, and required by the MTS to be installed on the bus by the Contractor, if the following conditions apply: the MTS has rejected the Contractor's requests for approved equal under "Proposer Communications and Requests" (Section 1.4 of MTS's solicitation), and the component or major subsystem supplier declines to participate in this warranty; and the Contractor notifies the MTS in writing with, or before submitting, Contractor's original Offer. The Contractor shall pass on to the MTS any warranty, offered by a component supplier, that is superior to that required herein.

#### **4.8 DETECTION OF DEFECTS**

If the MTS detects a defect within the warranty periods defined in "Warranty Requirements" (Section 4.0), it shall within twenty (20) working days, notify the Contractor's representative. Within five (5) working days after receipt of notification, the Contractor's representative shall either agree that the defect is in fact covered by warranty, or reserve judgment until the subsystem or component is inspected by the Contractor's representative or is removed and examined at the MTS's property or at the Contractor's plant. At that time, the status of warranty coverage on the subsystem or component shall be mutually resolved between the MTS and the Contractor. Work shall commence to correct the defect within ten (10) working days after receipt of notification and shall be conducted in accordance with "Repairs by Contractor" (Section 4.13).

#### **4.9 SCOPE OF WARRANTY REPAIRS**

When warranty repairs are required, the MTS and the Contractor's representative shall agree within five (5) working 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 (5) day period, the MTS reserves the right to commence the repairs in accordance with "Repairs by MTS" (Section 4.14).

#### **4.10 OCCURRENCE AND REMEDY FOR FLEET DEFECTS**

A fleet defect is defined as cumulative failures of any kind in the same components in the same or similar application where such items covered by the warranty and such failures occur in the warranty period in the specified proportion of the buses delivered under this contract. For deliveries of over fifty (50) buses, the proportion shall be fifteen (15%) percent. For deliveries of four (4) to forty-nine (49) buses the proportion shall be twenty (20%) percent.

The Contractor shall correct a fleet defect under the warranty provisions defined in "Repair Procedures" (Section 4.12). After correcting the defect, the MTS and the Contractor shall mutually agree to and the Contractor shall promptly undertake and complete a work program reasonably designed to prevent the occurrence of the same defect in all other buses and spare parts purchased under this contract. Where the specific defect can be solely attributed to particular identifiable part(s), the work program shall include redesign and/or replacement of only the defectively designed and/or manufactured part(s). In all other cases, the work program shall include inspection and/or correction of all of the buses in the fleet via a mutually agreed to arrangement.

#### **4.11 EXCEPTIONS TO FLEET DEFECT PROVISIONS**

The fleet defect warranty provisions shall not apply to MTS-supplied items such as fareboxes, radio and fare collection equipment, communication systems, and tires.

Fleet defect warranty provisions shall not apply to components and major subsystems specified by the MTS and required by the MTS to be installed on the bus by the Contractor, if the following conditions apply: the MTS has rejected the Contractor's requests for approved equal under "Proposer Communications and Requests" (Section 1.4 of MTS's solicitation) and the component or major subsystem supplier declines to participate in this warranty; and the Contractor notifies the MTS in writing with, or before submitting, Contractor's original Offer. The Contractor shall pass on to the MTS any warranty, offered by a component supplier, that is superior to that required herein.

#### **4.12 REPAIR PERFORMANCE AND PROCEDURES**

The Contractor is responsible for all warranty-covered repair work. To the extent practicable, the MTS will allow the Contractor or its designated representative to perform such work. At its discretion, the MTS may perform such work if it determines it needs to do so based on transit service or other requirements. Such work shall be reimbursed by the Contractor.

**4.13 REPAIRS BY CONTRACTOR**

The Contractor or its designated representative shall begin work on warranty-covered repairs, within five (5) calendar days after receiving notification of a defect from the MTS. The MTS shall make the bus available to complete repairs timely with the Contractor repair schedule.

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

**4.14 PARTS USED AND REPAIRS BY MTS**

If the MTS performs the warranty-covered repairs, it shall correct or repair the defect and any related defects utilizing parts supplied by the Contractor specifically for this repair. At its discretion, the MTS may use Contractor-specified parts available from its own stock if deemed in its best interest. Monthly, or at a period to be mutually agreed upon, reports of all repairs covered by this warranty shall be submitted by the MTS to the Contractor for reimbursement or replacement of parts. The Contractor shall provide forms for these reports.

**4.15 CONTRACTOR SUPPLIED PARTS**

The MTS may require that the Contractor supply new parts for warranty-covered repairs being performed by the MTS. These parts shall be shipped prepaid to the MTS from any source selected by the Contractor within ten (10) working days of receipt of the request for said parts. Parts supplied by the Contractor shall be Original Equipment Supplier (OEM) equivalent or superior to that used in the bus original manufacture.

**4.16 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 shall be paid by the Contractor. Materials should be returned in accordance with Contractor's instructions.

**4.17 FAILURE ANALYSIS**

The Contractor shall, upon specific request of the MTS, provide a failure analysis of fleet defect- or safety-related parts, or major components, removed from buses under the terms of the warranty, that could affect fleet operation. Such reports shall be delivered within sixty (60) days of the receipt of failed parts.

**4.18 REIMBURSEMENT FOR LABOR**

The MTS shall be reimbursed by the Contractor for labor. The amount shall be determined by multiplying the number of man-hours actually required to correct the defect by a per hour, 5M mechanic, straight wage rate, twenty-five (25%) percent fringe benefits, plus fifty-eight (58%) percent overhead, plus the cost of towing in the bus if such action was necessary. These wage and fringe benefits rates shall not exceed the rates in effect in the MTS's service garage at the time the defect correction is made.

**4.19 REIMBURSEMENT FOR PARTS**

The MTS shall be reimbursed by the Contractor for defective parts and for parts that must be replaced to correct the defect. The reimbursement shall be at the current price at the time of repair and shall include taxes where applicable and fifteen (15%) percent handling costs.

**4.20 REIMBURSEMENT REQUIREMENTS**

The Contractor shall reimburse the MTS for warranty labor and/or parts within sixty (60) days of receipt of warranty claim.

**4.21 WARRANTY AFTER REPLACEMENT/REPAIRS**

If any component, unit, or subsystem is repaired, rebuilt or replaced by the Contractor, or by the MTS with the concurrence of the Contractor, the component, unit, or subsystem shall have the unexpired warranty period of the original. Repairs shall not be warranted if Contractor-provided or authorized parts are not used for the repair; unless the Contractor has failed to respond within five (5) days, in accordance with "Scope of Warranty Repairs" (Section 4.9).

The warranty on items determined to be fleet defects as defined in Section 4.8 shall be extended for the time and/or miles of the original warranty remaining at the time the fleet defect was identified. This extended warranty shall begin on the repair/replacement date for corrected items on each bus.

<b>SECTION 5</b>
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### **35' ADVANCED DESIGN LOW FLOOR TRANSIT BUS TECHNICAL SPECIFICATIONS**

#### **5.0 GENERAL**

The following technical specifications represent MTS's minimum core requirements for 35' transit buses. Buses submitted for acceptance shall conform to the following core requirements. Deviations from this specification or substitutions from specified materials, parts and equipment shall not be undertaken without prior written approval from the MTS. (Section 1.4 and 1.5 "Proposers Communications and Requests" and "MTS Responses to Communications and Requests" for details on this process). Any exceptions, conditions, reservations, understandings or deviations must be explicitly and fully separately stated in your proposal. All exceptions, conditions, reservations, understandings or deviations will be evaluated by comparing it to the core requirements. If it is found to less than the minimum core requirements, MTS may view the proposal negatively and rate it accordingly.

The description of the any proposed bus must follow the same format as these technical specifications. Your response to this specification must address each categorical requirement in the same proceeding order.

MTS anticipates confirming the initial order quantity immediately after the acceptance of an offer is issued, approximately September 2007. MTS expects delivery of the first article bus to take place in the month of July 2008. Any deviation from the delivery of the first article bus must be submitted for approval by MTS as described in Section 1.4. Year one (1) of the Contract MTS will purchase a minimum of ten (10) or up to twenty (20) each 35' advanced designed heavy duty transit buses. This order shall include a first article (pilot bus), which shall be completed and delivered, with production beginning after a lapse of at least thirty (30) days after delivery of first article.

#### **5.1 TECHNICAL REQUIREMENTS FOR THE BASIC BODY**

These technical specifications define requirements for a heavy duty, 35' low floor, Compressed Natural Gas (CNG) Electric Hybrid powered transit bus, which shall be used for service on urban arterial streets. It shall have a minimum expected life of twelve (12) years or 500,000 miles which ever comes first and is intended for the widest possible spectrum of passengers, including children, adults, the elderly, and persons with disabilities. The buses shall have two (2) curbside doors, one (1) ahead of the first axle, and one (1) ahead of the drive axle.

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

These buses are to be utilized on a specialized demonstration service designated "Super Loop." Therefore, proposals must incorporate a unique exterior that is aesthetically pleasing with a sleek, modern look. MTS expects to purchase vehicles that are significantly distinguished in appearance from current Advanced Design Bus (ADB) concepts, with an exterior that appears progressive and modern, taking on the attributes of aerodynamic vehicle styling. Submitted proposals must include artist's renderings of what the exterior of the finished product will look like. The "Super Loop" service area infrastructure will utilize ten (10") inch raised platform stops; therefore bus step height shall be between thirteen and sixteen (13" and 16") inches from pavement.

## **5.2 WEIGHT OF BUS**

Total vehicle weight including a minimum of thirty (30) seated passengers plus allowing for fifty (50%) percent standees shall not exceed California State Law regulations regarding rated load carrying capacity of axles. Buses must comply with 23 C.F.R. part 658 of the Federal Department of Transportation Regulations and California Vehicle Code Sections 35550 - 35558. Buses not meeting these criteria will not be accepted.

During final inspection, the buses will be weighed. Buses exceeding the gross vehicle weight as stated on the bus specifications sheet, submitted with your proposal, will be assessed a penalty of \$2.00 per pound for each pound over the stated weight. Buses exceeding California Weight limit may not be accepted.

## **5.3 PROPULSION SYSTEM**

The propulsion unit will be located in the rear of the bus and shall be a CNG/Electric Hybrid series configuration utilizing the ISE Hybrid Drive System, or approved equal. MTS will entertain and consider alternate hybrid systems but the CNG/Electric Hybrid series configuration utilizing the ISE Hybrid Drive System is our preference and will receive the highest technical rating. MTS will also entertain or consider proposals on a standard engine/transmission CNG propulsion system but again this is not our preference. Proposals that utilize a standard engine/transmission CNG propulsion system may receive a lower technical rating during evaluation. A proposer may submit proposals on multiple propulsion systems but you must submit a separate cost and price proposal for each system proposed. (See Section 5.86 CHASSIS SPECIFICATIONS).

## **5.4 EXTERIOR PANELS**

Roof and crown panels shall be aluminum or fiberglass. Crown panel over entrance door shall be steel with steel inner reinforcement. Body side panels shall be of .080 inch thick aluminum or steel. Exit door shall be reinforced with heavy structural steel.

## **5.5 ALL SKIRT PANELS**

Skirt panels below rub-rail can be of Kevlar, aluminum or fiberglass construction. Rear structure above the floor line shall consist of an aluminum/steel bulkhead which separates the passenger compartment from a rear upper component compartment. The inside of this bulkhead shall be covered with dark carpet or fabric that is graffiti resistant. Edges of carpet material shall have trim or moldings to prevent peeling.

The engine compartment door shall be .063 inch thick aluminum hinged at the top with a stainless steel piano type hinge across the entire length of door. Two (2) gas (pneumatic) cylinder door props shall be provided on all service compartment doors and the air conditioner compartment door. Side closure door shall be hinged at top with stainless steel piano type hinge. All access doors will be secured with square key locks. All service compartments shall provide service lights to aid the mechanics when servicing bus on the road. All fasteners shall be treated to prevent corrosion.

The front and rear license plate bracket shall be flush mounted. Front license plate, which cannot be obstructed by bike rack, shall be mounted on the front of the bus in the area over the curbside turn signal lamp.

In no case will aluminum exterior body panels less than .063 inch thick be acceptable.

## **5.6 METAL PROTECTION**

All metal panels and structural members shall be protected from rust and corrosion by thorough pretreatment prior to assembly operations. All frame tubing below window line shall be sprayed internally with an anticorrosion compound. This may include chemical treatment and prime painting as required to insure this protection.

Caulking compound shall be used to seal interior body seams, joints and overlapping panels against water, dust, moisture and foreign matter. The sealant shall also be suitable for protection against electrolysis between dissimilar metals. A sealant containing a chromate inhibitor is to be used.

Prior to final painting and detailing of the surface, the body shall be cleaned and spot-primed to protect bare spots, and a surface sealant shall be applied to insure paint adhesion.

The bus flooring, sides, roof, understructure, axle suspension components shall resist corrosion or deterioration from atmospheric conditions and road salts for a period of twelve (12) years or 500,000 miles which ever comes first. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, provided that it is maintained by the Procuring Agency in accordance with the procedures specified in the Contractor's service manual. With the exception of periodically inspecting the visible coatings applied to prevent corrosion and reapplying these coatings in limited spots, the Contractor shall not require the complete reapplication of corrosion compounds over the life of the bus.

## **5.7 NOISE LEVELS / INTERIOR NOISE LEVEL**

The combination of inner and outer panels and any material used between them shall provide sufficient sound insulation so that an exterior sound source having up to an 80 dB sound level measured at the outside skin of the bus shall have a sound level of 65 dB or less at any point in the interior of bus. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and all accessories switched off. The vehicle-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 75 dB and the operator shall not experience a noise level of more than 65 dB under the following test conditions. The bus shall be empty except for test personnel, not to exceed four (4) persons, and the test equipment. All openings shall be closed and all accessories shall be operating during the test. The bus shall accelerate

with the generator engine operating at full load from a standstill to 35 mph on a level, smooth, urban arterial road or highway in an area free of large reflecting surfaces within fifty (50') feet of the bus path. During the test, the ambient noise level in the test area shall be at least 10 dB lower than the bus under test. The bus shall not be operated in an "all electric mode" during this test. Instrumentation and other general requirements shall conform to SAE Standard J366.

#### **5.8 EXTERIOR NOISE LEVEL**

Airborne noise generated by the bus and measured from either side shall not exceed 75 dB under full power acceleration when operated at or below 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 75 dB. The bus shall not be operated in an "all electric mode" during this test. The bus-generated noise with the generator engine at curb idle shall not exceed 60 dB. All noise readings shall be measured at a distance of fifty (50') feet from and perpendicular to the center of the lane of travel with all accessories operating. Instrumentation, test sites, and other general requirements shall conform to SAE Standard J366. The pull away test shall begin with the front bumper even with the microphone. The generator engine curb idle test shall be conducted with the rear bumper even with the microphone.

#### **5.9 MISCELLANEOUS FASTENERS**

All bolts, nuts, washers, clamps, clips and like parts installed by contractor shall be stainless steel, zinc cadmium plated, or phosphate coated to prevent corrosion. All fasteners shall be manufactured in the USA or Canada.

### **DOORS**

#### **5.10 PASSENGER DOORS TYPE**

Front door shall be double-stream, slide-glide type. Rear door shall be power open, power close slide-glide type.

#### **5.11 EMERGENCY DOORS OPERATION**

In the event of an emergency, it shall be possible to open the front and rear passenger doors manually from inside the bus using a force of no more than twenty-five (25) pounds after actuating an unlocking device at each door. The unlocking devices shall be clearly marked as "Door Emergency Release." The unlocking devices shall be clearly marked as an emergency only device and shall require two (2) distinct actions to actuate. The emergency door unlocking devices shall be accessible from the step well areas.

When these emergency devices are actuated, the door brake interlock system shall apply to stop the bus, regardless of the position of the door master switch.

Locked doors shall require a force greater than one hundred fifty (150) 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 or complex door operating mechanism.

**5.12 REAR DOOR OPENING FORCE**

An opening rear door shall impose no more than a fifteen (15) pound force on a one (1") square-inch area of any passenger struck by it. A maximum force of thirty-five (35) pounds shall be required for passengers to free themselves after having either door open on them.

**5.13 CLOSING DOOR FORCE**

Closing door edge speed shall not exceed nineteen (19") inches per second. The power close rear doors shall be equipped with a sensitive edge and an obstruction sensing system such that if an obstruction is struck or sensed by a closing door edge, the doors will stop and/or reverse direction prior to imparting a ten (10) pound force on one (1") square inch of that obstruction. Whether or not the obstruction sensing system is present or functional it shall be possible to withdraw a one and one-half (1½") inch diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than thirty-five (35) pounds.

**5.14 DOOR MASTER SWITCH**

A door master switch shall be located in a compartment at the front of the bus which must be able to be opened without tools. This switch shall shut off the electrical circuits to the rear door and the rear door interlocks in the event of a malfunction of the door or interlock controls. With this master switch in the "Off" position, the rear door remains locked and the interlocks do not function. The switch shall not affect non-door interlocks from functioning. The switch shall not affect the operation of the front door or rear door emergency exit operation.

**5.15 DOOR DIMENSIONS**

When open, the doors shall leave an opening no less than seventy-six and one-half (76½") inches in height. Front door shall have a minimum clear opening width of thirty-two (32") inches for the entire vertical height of the door.

**5.16 DOOR GLAZING**

The upper section of rear doors shall be glazed for no less than forty (44%) percent of the respective door opening area of each section. The front door shall be glazed with a full length single glass section from top of door to bottom. The edge of a six (6") inch high curb shall be visible to the seated operator through the closed front door when the bus is more than twenty (12") inches from the curb. Front and rear door windows shall be glazed with "Heat Guard" product as manufactured by Transit Products and Services of Banning, CA, or approved equal. Glazing shall be ¼" inch tempered safety glass conforming to Federal Motor Safety Standards (FMVSS) 205 and applicable requirements of American National Standards Institute (ANSI) Z26.1-1997 and the Recommended Practices defined in SAE J673. The total visible light transmittance must not be below seventy-six (76%) percent as measured by American Society of Testing and Materials (ASTM) E-424. The LSG (light to solar gain ratio) must be a minimum of 1.28. The reflective heat gain must meet a minimum requirement of 150 British Thermo Unit (BTU)/hr/sq.ft. Rear door glazing tint shall match that of side passenger windows.

**5.17 DOOR HEIGHT ABOVE PAVEMENT**

Door step height (floor height) shall be between thirteen and sixteen (13" and 16") inches from street in the unkneeled position when loaded to GVWR. It shall be possible to open and close passenger doors when the bus, loaded to GVWR, is not kneeled and parked with the curbside tires touching an eight (8") inch high curb on a street sloping toward the curb so that the street-side wheels are five (5") inches higher than the curbside wheels. It shall also be possible to open and close passenger doors when the bus, loaded to GVWR, is pulled up to within three (3") inches along side a ten (10") inch high raised platform stop.

**5.18 FRONT DOOR**

Front door on the curbside ahead of the front wheelhouse shall be anodized aluminum, two section slide-glide types. Door hinges shall be stainless steel, joints shall be covered with rubber waterproofing seals.

Door shall be operated from a door control actuator at roadside of driver which controls a Vapor, or approved equal, pneumatic differential door engine mounted in a compartment over the door. A light with switch shall be provided in the door compartment to assist mechanics. Access door to compartment shall be hinged at the top and fastened with two (2) rotating knob-type latches.

**5.19 FRONT DOOR AIR DUMP VALVE**

An air dump valve that is connected to supply and/or exhaust all air from the front door engine shall be provided. With the valve in the "Off" position the front door shall be capable of being opened and closed manually. The door air dump valve shall be installed at the left of the operator's position and shall display the following operating instructions:

**TURN HANDLE TO "OFF" FOR OPENING FRONT DOORS MANUALLY**

**5.20 REAR EXIT DOOR**

The rear exit door shall be an aluminum two (2) section "power open, power close" slide-glide type door. A light with switch shall be provided in the door compartment to assist mechanics. The exit door of the vehicle shall be equipped with an acoustic system to secure passenger and other objects in the door way and between the fully opened or partially closed door panels. The Acoustic Sensing System shall be the "Class" System as manufactured by the Vapor Corporation, or approved equal.

**5.21 DOOR PROJECTION**

The exterior projection of the doors shall be minimized and shall not exceed six and one-half (6½") inches measured from the sidewall of the bus during the opening or closing cycles or when doors are fully opened. Projection inside the bus shall not exceed twenty (20") inches. The closing edge of each door panel shall have no less than two (2") inches of soft weather stripping. The doors, when closed shall be effectively sealed and the hard edges of the individual door frames shall be at least four (4") inches apart.

## 5.22 FRONT AND REAR DOOR CONTROL

The door control actuator shall operate the front and rear doors separately or simultaneously. A Vapor five (5) position door control, or approved equal, shall be mounted to the left of the driver positioned forward from center of the steering column. The control lever positions shall be as follows:

<u>LEVER POSITION</u>	<u>FRONT DOOR</u>	<u>REAR DOORS</u>
Extreme Forward	Open	Open
1st position forward	Open	Closed
Center position	Closed	Closed
1st position rear	Closed	Open
Extreme rear	Open	Open

Operator shall have full control of rear exit doors opening and/or closing function.

The door control actuator, dump valve, and adjacent parts shall be accessible through the front exterior electrical panel and/or interior side console.

## SERVICE COMPARTMENTS AND ACCESS DOORS

### 5.23 EXTERIOR SERVICE COMPARTMENTS AND ACCESS DOORS

Conventional hinged doors with stainless steel piano type hinges and stainless steel pins shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity of and adding to the engine coolant and the windshield washer reservoir. The windshield washer reservoir door shall be located in the front of the bus. Access to all other compartments shall be from the outside rear of the bus. Generator engine coolant shall be added through the same access door as the coolant level is checked. The surge tank door shall be adequately sized for ease of accessibility.

No separate access doors shall be provided on the engine compartment door for the engine oil dipstick. Engine oil level shall be serviced through the main engine compartment door. Access openings shall be sized for easy performance of tasks within the compartment including tool operating space. Access doors shall be of rugged construction and shall be capable of withstanding severe abuse throughout the life of the bus. Access doors shall close flush with the body surface. All access doors shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be retained in the open and closed position by counterbalancing with over-center or gas filled struts. Springs and hinges shall be corrosion resistant and shall last over the bus's service life. The utilization of 5/16" inch square key latches is permitted where necessary. Access doors shall hinge up and out of the way or fold flat against the bus body and shall be easily operable by one person. These doors, when opened, shall not restrict access for servicing components or systems and compartments shall be provided with service lights.

The rear hybrid propulsion system access door shall be latched closed by use of flush mounted square key latch mechanisms. The street side gas support strut shall have a locking mechanism that locks in the open position. The rear hybrid propulsion system access door shall incorporate an exterior handle mounted to lower center of door, as well as, an interior handle mounted off center on street side. A hinged and removable belt guard shall be provided, with a latching device, for easy access to engine belts, pulleys and accessories.

Undercarriage steering box access doors must be hinged for easy access and shall be latched closed by use of a flush mounted square key latch mechanism.

Curbside battery compartment door shall have a minimum of six hundred (600") square inches of expanded steel screen or other opening to aid in heat removal from the engine compartment.

Any hinged skirt panel is considered to be an access door for the purposes of this section.

#### **5.24 UNDERBODY**

Any underbody inspection covers shall be hinged and utilize square key latches. Inspection covers using screws is not acceptable.

#### **5.25 INTERIOR**

Rear bulkhead shall have access panels on curbside and street-side. Access panels shall be minimum 18" x 18" in size.

#### **5.26 WINDSHIELD WIPERS AND WASHERS**

The bus shall be equipped with an electric operated Sprague, or approved equal, variable speed windshield wiper for each half of the windshield. Separate controls for each side shall be supplied. An independent variable intermittent wiper feature shall be provided to allow adjustment of the individual wiper speed between approximately 5-to-25 cycles per minute.

Wiper motors and arms shall be of the type to provide maximum visibility for the operator and shall not obstruct operators view when wipers are parked. No part of the windshield wiper mechanism shall be damaged by manual manipulation of the arms. At 60 mph, no more than ten (10%) percent of the wiped area shall be lost due to windshield wiper lift. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service and shall be removable as complete units. Exposed hardware such as bolts and bushings shall be stainless steel or otherwise corrosion resistant.

Windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area. The windshield washer shall incorporate an electric type pump. The windshield washer reservoirs shall be mounted at the front of the bus with provision for exterior fill through a small swing-open door at the front of the bus. Reservoir shall be a translucent plastic for easy determination of fluid level with a minimum capacity of two (2) U.S. gallons.

Windshield washer spray nozzles shall not be located anywhere on the windshield wiper arms. Wet arm wipers shall not be accepted.

## WINDOWS

### **5.27 WINDSHIELD**

The windshield shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of fifteen (15°) degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object three and one-half (3½') feet high no more than two (2') feet in front of the bus. The horizontal view shall be a minimum of ninety (90°) degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the ninety (90°) degree requirement, provided that the divider does not exceed a three (3°) degree angle in the operator's field of view. Windshield pillars shall not exceed ten (10°) degrees of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshield shall not be used. The windshield glazing material shall have a ¼" inch or 6 mm nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673. The glazing material shall have single density tint. The upper portion of the windshield above the operator's field of view shall have a dark, shaded band with a minimum luminous transmittance of six (6%) percent when tested in accordance to ASTM D-1003.

### **5.28 OPERATOR'S DOOR, AND PASSENGER SIDE WINDOWS**

The total available window open area shall be 18,800 square inches minimum, excluding windshield and broken down as follows:

Curbside:	8,500 square inches minimum
Street-side:	8,800 square inches minimum
Rear Window (if equipped):	1,500 square inches minimum

If design is such that no rear window is incorporated, the total available window open area shall be 17,300 square inches minimum, excluding windshield.

Each driver and passenger window, front and rear door windows, shall be glazed with HEAT GUARD product as manufactured by Transit Products and Services located in Banning, CA, or approved equal. The driver's window assembly and passenger window assembly glazing shall be ¼" inch thick tempered safety glass, both conforming to FMVSS 205 and applicable requirements of ANSI Z26.1-1997. The total visible light transmittance for driver's and front door glazing must not be below seventy-six (76%) percent as measured by ASTM E-424. The LSG (light to solar gain ratio) must be a minimum of 1.28. The relative heat gain must meet a minimum requirement of 150 BTU/hr/sq. ft.

Passenger windows and rear door glazing shall be equally tinted with a twenty-eight (28%) percent luminous transmittance grey color tint.

All passenger windows shall be full fixed egress window assemblies with the exception of the driver egress window and destination window assemblies. The windows should be seamless in style giving the entire bus a "Euro" single body glazing appearance. All aluminum and steel material shall be black powder coated to help prevent corrosion. All passenger windows and driver's window shall be quick-change design, without "Glass Guard" as manufactured by Riconcorp located in Panorama City, CA, or approved equal.

The window glazing shall be designed such that it can be replaced in three (3) minutes or less by a trained technician. Glazing in the window assembly shall be replaced without removing the window from its installed position on the bus or manipulation of the rubber molding surrounding the glazing. The glazing shall be held in place mechanically by a formed metal extruded ring constructed to last the life of the vehicle. The metal extruded ring shall act as part of the structure of the window. The exterior glazing shall be mounted securely in the existing window extrusion without the sacrificial liner installed in the window assembly.

Driver's window is top fixed bottom  $\frac{3}{4}$  slider. Rear slider can either be fixed or sliding. The driver's window shall open sufficiently allowing the seated driver to adjust the side view mirror arm and shall not obstruct the view of the driver when in the fully open or closed position. All windows must meet FMVSS 205 and all windows shall meet the minimum two hundred seventeen (217) requirements. The side destination sign window assembly shall be split fixed with the transom glazing clear. All emergency handles shall be located on the right side of the window assemblies. Emergency exit and window release lever operation instructions must be metal and be permanently attached to window frame rail adjacent to and within six (6") inches of each window release lever. Emergency window operating instructions shall be printed in both English and Spanish.

All windows rear of the exit door shall be equipped with "Scotchgard" 1004 Multi-Layer Protective Film for Glass as manufactured by 3M Industrial, or approved equal. This optically transparent, pressure sensitive polyester film tape shall be designed to protect the interior of the windows from intentional mutilation, scratching, and etching. A defaced layer shall have the ability to be quickly and easily removed, exposing a fresh protective sheet.

## **MIRRORS**

### **5.29 GENERAL MIRRORS**

The bus shall be equipped with a corrosion-resistant, outside rearview mirror on each side of the bus. The mirrors shall permit the operator to view the roadway along both sides of the bus, including the rear wheels. The mirrors are to be designed in such a way that allows for firm attachment to the bus to prevent vibration and loss of adjustment, but not so firmly attached that the bus or its structure is damaged when the mirror is struck in an accident. Mirrors shall retract or fold sufficiently to allow bus washing operations.

### **5.30 CURBSIDE MIRRORS**

The curbside mirror shall be Hadley-Elkhart (formally B&R Mfg.) Ref. Model BRT 1000 Series, or approved equal, remote adjustable 8"W x 15"H mirror. The mirror is to be constructed of high impact ABS plastic with a black finish. Mirror head shall be attached using a nitro-carbonizing ball and clamps into a cast aluminum arm powder coated flat

black. The mirror design is a friction mount construction that allows for the mirror assembly to be folded during bus washing or when incidental contact occurs. The operator shall be able to adjust flat or convex portion remotely while seated in the driving position. The control for the remote positioning of the mirror shall be a single or dual switch or device. The flat and convex mirrors shall be electrically heated with heater being energized whenever the operator's heater and/or the defroster is activated. An Light Emitting Diode (LED) turn signal shall be incorporated in the outside portion of the mirror housing that allows visibility from the side and rear of the vehicle. The mirror is to be top mounted on the side of the bus and shall be mounted so that its lower edge is no less than eight (80") inches above the street surface with visibility through the wiper area of the windshield.

### **5.31 STREET-SIDE MIRRORS**

The roadside mirror shall be Hadley-Elkhart (formally B&R Mfg.) Ref. Model BRT 1000 Series, or approved equal, remote adjustable 8"W x 15"H mirror. The mirror is to be constructed of high impact ABS plastic with a black finish. Mirror head shall be attached using a nitro-carbonizing ball and clamps into a cast aluminum arm powder coated flat black. The mirror design is stationary. The operator shall be able to adjust flat or convex portion remotely while seated in the driving position. The control for the remote positioning of the mirror shall be a single or dual switch or device. The flat and convex mirrors shall be electrically heated with heater being energized whenever the operator's heater and/or the defroster is activated. An LED turn signal shall be incorporated in the outside portion of the mirror housing that allows visibility from the side and rear of the vehicle. The mirror is to be top mounted on the side of the bus and shall be mounted so that its lower edge is no less than eighty (80") inches above the street surface with visibility through the side driver's window with the window closed or fully open.

### **5.32 INTERIOR MIRRORS**

A fully adjustable Lucerix, or approved equal, 8"W x 15"H convex operator's rear view mirror with an approved type safety rim (black), shall be mounted just above the windshield to left of centerline.

Two (2) separate adjustable Lucerix, or approved equal, six (6") inch round flat mirrors with an approved type safety rim (black), shall be installed in combination (at right front of bus) to provide operator view of rear (exit) door and front mounted bike rack. One (1) adjustable Lucerix, or approved equal, twelve (12") inch round convex mirror with an approved type safety rim (black), shall be installed at rear exit door.

### **5.33 WHEELHOUSES**

Wheel housings shall be minimum 14 gauge stainless steel. Front wheel housing covers shall be fiberglass "Gel-coated" (finish and color to be determined at pre-production meeting). Scuff guards constructed of .050" thick stainless steel rising ten (10") inches from floor level shall be located around the base of the front wheel house covers. Scuff guards shall be secured with stainless steel screws.

## **BUMPERS**

### **5.34 GENERAL BUMPERS**

Front and rear bumpers shall be Romeo Rim, or approved equal, three piece, (color to be determined at pre-production meeting) energy absorbing bumpers. The rear bumper shall be of the anti-ride type. The bumper height shall be such that when one bus is parked behind another, a majority portion of the bumper faces will contact each other. The front and/or rear bumper systems shall utilize the following materials and construction:

Energy absorbing modules are to be self-restoring, integral urethane. The back structure is to be fabricated with aluminum and provide a single full length structural support for modules. The bumper construction shall permit easy disassembly and service of modules and structural components independently of one another.

### **5.35 FRONT BUMPER**

No part of the bus, including the bumper shall be damaged as a result of any 5 mph impacts with a fixed, flat barrier perpendicular to the bus' longitudinal centerline of the vehicle. The bumper shall return to its original shape within ten minutes of the impact. The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the Common Carriage with Contoured Impact Surface defined in Figure 2 of FMVSS 301 loaded to 4,000 pounds parallel to the longitudinal centerline of the bus and 5.5 mph impacts into the corners at a thirty (30°) degree angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length by no more than seven (7") inches.

### **5.36 REAR BUMPER**

No part of the bus, including the bumper shall be damaged as a result of any 2 mph impacts with a fixed, flat barrier perpendicular to the bus' longitudinal centerline of the vehicle. The bumper shall return to its original shape within ten minutes of the impact. When using a yard tug with a smooth, flat plate bumper two (2') feet wide contracting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph over pavement discontinuities up to one (1") inch high, and at accelerations up to 2 mph/second. The bumper shall protect the bus from damage as a result of 4 mph impacts at any point by the Common Carriage with Contoured Impact Surface defined in Figure 2 of FMVSS 301 loaded to 4,000 pounds parallel to the longitudinal centerline of the bus or impacts into the corners at a thirty (30°) degree angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length by no more than seven (7") inches. The bumper shall also provide an integral "Anti-Ride" geometry to preclude the possibility of standing on the bumper.

**5.37 TOW EYES**

Two (2) tow eyes shall be installed at the front of the bus and at least one (1) at the rear.

**5.38 UNDERCOATING**

The entire bus understructure, including wheelhouses and step wells, but excluding the Air dryer, air lines, air valves, driveshaft and axles, shall be spray coated with a heavy duty Tectyl #185, or approved equal, aluminum pigmented, non-flammable, corrosion preventive compound. Particular attention should be directed to areas of water, salt and foreign matter collection and compaction on the underside of the bus.

**5.39 SPLASH APRONS AND FENDERS**

Exterior front and rear wheel well splash aprons (mud flaps) shall be fabricated of rubber and/or rubber and fiber composition. Splash aprons shall be a minimum ¼" inch thick and shall be installed behind the front and rear wheels and extend to within two and one-half (2½") inches of the ground. Rear axle splash aprons shall be of three (3) piece construction and extend the full width of the bus with a large center section protecting the open hybrid generator bay. Molded rubber fenders shall be installed at front and rear wheelhouses.

**INTERIOR BODY SPECIFICATIONS****5.40 FLOORS**

The floor design shall consist of two (2) levels (bi-level construction). Aft of the rear door extending to the rear settee riser, the floor height may be raised to a height approximately eighteen (18") inches above the lower floor level. An increased slope shall be allowed on the upper level not to exceed three point five (3.5°) degrees off the horizontal floor line. Where the floor meets any vertical surfaces, such as platform risers, the surface edges shall be blended with a circular section of radius not less than one (1") inch. Similarly, a molding or cove shall prevent debris accumulation between the floor and the wheel housings. The vehicle floor in the area of the entrance and exit doors shall have a lateral slope not exceeding two (2°) degrees to allow for drainage.

The floor material shall be ¾" inch, pressure-treated 7-ply plywood with a preservative chemical that prevents decay and damage by insects. Preservative chemicals shall contain no EPA listed hazardous chemicals. Plywood shall be installed with the highest grade veneer up. Pressure treated plywood shall have a moisture content at or below fifteen (15%) percent. A barrier shall be installed to prevent contact by road salt with the plywood panels. Shaped and cut edges shall be sealed with linseed oil and titanium dioxide.

Floor may be integral with the basic structure or mounted on the structure securely, using corrosion resistant fasteners, to prevent chafing or horizontal movement and designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor and all floor fasteners shall be serviceable from one side only. The use of adhesives to secure the floor to the structure shall be allowed only in combination with the use of bolt or screw fasteners and its effectiveness shall last throughout the life of the bus. Tapping plates, if used for the floor fasteners, shall be no less than the same

thickness as a standard nut and all floor fasteners shall be secured and protected from corrosion for the service life of the bus. The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 inches from the normal plane. The floor shall withstand the application of two point five (2.5) times gross load weight without permanent detrimental deformation. Floor with coverings applied, shall withstand a static load of at least one hundred fifty (150) pounds applied through the flat end of a ½" inch diameter rod, with 1/32" inch radius without permanent visible deformation. Any gaps and fastener heads shall be caulked and sanded prior to application of adhesive for floor covering.

#### **5.41 FLOOR COVERING**

Floor covering shall be Tarabus MK Series, color and pattern shall be determined at pre-production meeting and shall be transit grade, flooring material. Floor covering shall be installed to all floor areas up to the bottom of the seat rail including the driver platform and riser, rear deck riser, rear wheel housings, tops of front wheel housings and rear settee riser. A trim railing shall be installed that overlaps the top edge of floor covering along the seat rails from the front wheel housings to the rear door on the curbside and to the rear deck riser on the street-side of the bus.

A two (2") inch wide yellow standee line shall be provided to separate the passenger boarding entrance area from bus proper and a twenty-one to twenty-nine (21" to 29") inch yellow step area shall be provided at the rear door using Tarabus Safebus MK Series 6203 Borneo or approved equal. Nosings at the outside edge of the entrance and exit doors and at the rear steps to the upper deck shall utilize Altro Transflor yellow vinyl nosings, or approved equal. Entire plywood area shall be thoroughly sanded and cleaned prior to application of adhesive. Double faced bond technique shall be employed, i.e. adhesive shall be applied to back side of floor covering and wood floor so as to provide a permanent bond that will remain bonded for the service life of the bus.

The floor covering shall be seamless or seams shall be permanently sealed so as to eliminate the permeation of water to the wood flooring. Seams shall be bevel cut in preparation for welding of seams. Trim moldings shall be utilized on any exposed edges of floor covering material and shall be fabricated from stainless steel or anodized aluminum.

#### **5.42 INTERIOR PANELS**

Interior panels for the headlining and the areas between the windows from window line up to the ducting/lighting fixtures shall be 1/10" inch thick, hard-faced Melamine panels. Pattern/color for ceiling (headlining) panels and pier panel mullions shall be determined at the pre-production meeting. Sidewall panels from window line down to seat rail shall be leather grained aluminum.

Panels shall be heat and scratch resistant with hard board back. Panel joints shall be trimmed with stainless steel strips. Other trim strip materials shall be treated to resist rust, corrosion and other weathering and aging effects.

The front crown panel, driver's area and doors shall be painted non-glare black acrylic enamel. Dashboard upper section shall be smooth black metal or fiberglass construction. Lower area of the dash shall be painted non-glare black acrylic enamel. Rear wall above seat back shall be carpeted material (color to be determined at pre-production meeting) and will require trim or molding to prevent passengers from peeling it off.

#### **5.43 MODESTY PANELS**

Modesty panels shall be provided along the front edge of the rear upper level on both the curbside and street-side. Panel material shall be 0.060 inch leather grain finish aluminum. Panels shall utilize a metal edge trim on top, bottom, and inboard edges. Inboard edge of panels shall be attached to vertical aisle stanchions, outboard edge of panels shall be attached to bulkheads, and top/bottom edges of panels shall be attached to horizontal grab rails, which shall themselves be attached to bulkheads and aisle stanchions. The inboard edge of the panels shall be attached to vertical stanchions in the same manner as are the top and bottom edges. Panels shall extend to within two and one-half to three (2½" to 3") inches of floor to facilitate cleaning.

Plexiglas® barrier panels shall be provided on curbside forward and aft of the exit door to protect passengers on adjacent seats. Exit door barrier panels shall be ½" inch thick polycarbonate resin thermoplastic or granite acrylic resin material approximately twelve to fourteen (12" to 14") inches in width and shall extend high enough to prohibit passengers from getting an arm or hand caught by the door during opening and/or closing function. Barrier panels at exit door shall be protected on both sides with "Scotchgard" 1004 Multi-Layer Protective Film for Glass with stepped edge as manufactured by 3M Industrial, or approved equal. This optically transparent, pressure sensitive polyester film tape shall be designed to protect the glazing from intentional mutilation, scratching, and etching. A defaced layer shall have the ability to be quickly and easily removed, exposing a fresh protective sheet.

#### **5.44 ROOF ESCAPE/VENTILATION HATCH**

Two (2) low profile combination roof escape and ventilation hatches as manufactured by Transpec Worldwide, or approved equal, shall be provided. The hatches shall be located approximately over the front and rear axles. The hatch opening shall be not less than twenty-three to twenty (23" x 20") inches and shall have four (4) positions for ventilation. When open with the bus in motion, this ventilator shall provide fresh air inside the bus and be capable of being positioned as a scoop with either the leading or trailing edge open no less than four (4") inches, or with all four edges raised simultaneously to a height of no less than three and one-half (3½") inches. Roof hatches shall be sealed to prevent entry of water when closed and shall incorporate a lever type handle for emergency exit release. Hatches shall be labeled as emergency exits with instructions which shall be clearly visible in English and Spanish.

#### **5.45 PASSENGER SEATING AND CAPACITY**

All seats shall be "Insight" model with cushioned vandal resistant CR-50 upholstered inserts throughout, as manufactured by American Seating Company, or approved equal. The seating arrangement shall provide the maximum number of seats possible using a minimum twenty-eight (28") inch hip to knee room spacing. There shall be no less than thirty (30) total seats including the two (2) wheelchair tie down area seats. All seats shall be forward facing two (2) seat transverse type cantilever mounted, with the exception of two (2) longitudinal type seats for elderly/handicap passengers in extreme forward positions. Rear settee is to be separated in a 1-3-1 configuration and hinged separately for access to the hybrid engine and generator compartment. All elderly/handicap and wheelchair seats shall fold up and lock in the up position only. All forward facing seats shall have integral stainless steel grab rails at top of seat back and stainless steel back panels. All seats must meet or exceed FMVSS requirements and must conform to the same for installation requirements.

Seat plastic trim color and cushioned CR-50 inserts material pattern and color shall be determined at the pre-production meeting. The two (2) wheelchair securement areas shall be equipped with Advanced Restraint Module (A.R.M.) from American Seating with QRT deluxe retractor by Q-Straint, or approved equal. All wheelchair seating/layouts must meet or exceed ADA requirements.

#### **5.46 OPERATOR'S SEAT**

The operator's seat shall be a premium quality Recaro Ergometro Model AM80, or USSC Q91 Series (w/o side bolsters), or approved equal. The driver's seat shall be comfortable and adjustable so that persons ranging in size from the 95<sup>th</sup> percentile male to the 5<sup>th</sup> percentile female may operate the bus. While seated, the operator shall be able to make seat adjustments by hand without complexity, excessive effort, or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes. The angle formed between the seat back and the seat cushion shall be adjustable from a minimum of no more than ninety (90°) degrees (upright) to at least one hundred five (105°) degrees (reclined), with infinite adjustment in between. Height of the seat shall be adjustable so that the distance between the top of the uncompressed seat cushion and the floor may vary between a minimum of fourteen (14") inches to a maximum of twenty (20") inches, with a minimum of a six (6") inch range of adjustment. The operator's seat shall have a minimum of nine (9") inches of adjustment in the fore and aft direction without contacting any bus part. The seat cushion shall also be adjustable. The seat pan cushion shall adjust in its slope from no less than plus twelve (12°) degrees (rearward "bucket seat" incline), to no less than minus five (-5°) degrees (forward slope). The seat shall be installed in the same location in all buses. The operator's seat shall be appropriately dampened to support a minimum weight of 380 pounds and incorporate a dynamic load damper to augment the springing and padding in the cushions. Rubber bumpers shall be provided to prevent metal-to-metal contact if the seat "bottoms out." Any electrical and/or air connections to the seat shall have quick disconnect provisions to allow easy removal and replacement of the seat. Seat back and seat bottom cushion shall be black upholstery fabric on center portion of seat face, with black vinyl on sides and edges, and no welt cord shall be used. Foam shall be molded polyurethane with pneumatic lumbar support and pneumatic suspension system. Seat cushions shall be of long-lasting, polyurethane fire resistant foam. Particular attention shall be given to providing a seat which is comfortable in warm,

humid weather and which gives full consideration to long periods of occupancy. Operator's seat shall be mounted so that it can be removed by the maintenance personnel, by one mechanic in one half (½) hour for service or repair. This may include the use of captive fasteners to preclude the necessity for two (2) mechanics to perform the procedure.

The operator's seat shall be equipped with a fully retractable seat belt and separate shoulder harness restraint system. The shoulder harness and seat belt shall provide full adjustment of each strap. The belts shall be fastened to the seat so that the operator can adjust the seat without resetting the seat belt. Seat belts shall be stored in automatic retractors. This system shall not incorporate inertia type retractors. The seat belt shall extend from left to right and shall have a usable travel of at least sixty (60") inches measured from the open end of the protective boot to the end of the buckle or latch plate.

#### **5.47 OPERATOR AREA/DASH PANEL**

The operator's work area shall be designed to minimize glare to the maximum extent possible. Objects within and adjacent to this area shall be matte black in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the operator's area shall be avoided. Such objects include dash panels, switches and controls, cowlings, barriers, access panels, window frames, visors, etc. Any interior lighting forward of standee line shall be controlled by the operator. A dash route/fare card holder, driver's storage compartment, an 8-pocket acrylic Plexiglas® route map holder (see Operator Barrier section below), radio/GPS antenna access, and waste baskets shall be furnished and installed by manufacturer. Additional provisions for driver's area are included below.

#### **5.48 OPERATOR BARRIER**

The operator's barrier shall be a smooth, esthetically pleasing design, providing the appearance of an integral unit as opposed to a conglomeration of different constructive elements. The operator's barrier shall be constructed so that radio/camera equipment box, driver's storage box, schedule holder, and associated equipment are one integral unit. The design and construction of the operator barrier shall require MTS approval.

#### **5.49 DOCUMENT HOLDER**

An acrylic Plexiglas® holder designed to hold vehicle registration and/or insurance documents shall be provided. The document holder shall be approximately 10" x 10" inches in size and be mounted in driver's area.

#### **5.50 OPERATOR'S COAT HOOK**

A stainless steel coat hook, with ball and separate strap, shall be provided and mounted in operator's area such that when in use does not interfere with driving operation or obstruct the operator's view.

**5.51 OPERATOR'S STORAGE LOCKER**

A driver storage locker shall be provided. Storage locker shall be designed and integrated into the driver's barrier. Storage locker for the driver shall be approximately 18" x 18" x 18" in size and shall include a door with a latch. Design of locker will require MTS approval.

**5.52 VISOR**

One (1) padded sun visor shall be provided for the operator's side of the windshield. Visor shall be shaped and sized adequately to minimize light leakage between the visor and windshield pillars. Visor shall store out of the way and shall not obstruct air flow from climate control system or interfere with other equipment such as the radio handset or destination sign control. Sun visor construction and materials shall be strong enough to resist breakage during adjustments.

One (1) padded sun visor shall be provided for the driver's side window. Visor shall be shaped and sized adequately to minimize light leakage between the visor and driver's side window. Visor shall store out of the way and shall not obstruct air flow from climate control system or interfere with other equipment such as the radio handset or destination sign control. Sun visor construction and materials shall be strong enough to resist breakage during adjustments.

**PASSENGER ASSISTS****5.53 GENERAL PASSENGER ASSISTS**

Passenger assists in the form of full grip, vertical stanchions or handholds shall be provided for the safety of standees and for ingress/egress. Passenger assists shall be convenient in location, shape and size for both the 95<sup>th</sup> percentile male and the 5<sup>th</sup> percentile female standee. Starting from the entrance door and moving anywhere in the bus and out the exit door, a vertical assist shall be provided either as the vertical portion of seat back assist or as a separate item so that a 5<sup>th</sup> percentile female passenger may easily move from one assist to another using one hand and the other without losing support. All passenger assists in the front door and vestibule area shall be powder coated bright yellow to aid visually impaired passengers.

Interior handrails and stanchions shall permit sufficient turning and maneuvering space for wheelchairs and other mobility aids to reach a securement location from the ramp.

Handrails and stanchions shall be provided in the entrance to the vehicle in a configuration which allows person with disabilities to grasp such assists from outside the vehicle while starting to board, and to continue using such assists throughout the boarding and fare collection process. Handrails shall have a cross-sectional diameter between one and a quarter and one and one-half (1¼" and 1½") inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than ¼" inch. All passenger assists shall permit a full hand grip and shall be placed to provide a minimum one and one-half (1½") inches knuckle clearance from the nearest adjacent surface. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the boarding procedure. Passengers shall be able to lean against the assist for support while paying fares.

**5.54 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 panels. Rear doors shall be fitted with assists at the modesty panel to aid in the exiting of passengers. A 5<sup>th</sup> percentile female shall be provided assists that are functionally continuous during the entire exiting process and the assists shall be no more than four (4") inches from the outside edge of the lower step tread.

A full-size vertical assist that is functionally continuous with the overhead assist shall be provided on the aisle side of the modesty panels at the step wells. A full size assist no less than thirty-six (36") inches above the average step tread surface shall be provided in the middle of the rear door step well extending from the aisle to the outside edge of the lower step.

**5.55 VESTIBULE**

The aisle side of the operator's barrier, the wheel housings and when applicable the modesty panels shall be fitted with vertical passenger assists panels that are functionally continuous with the overhead assist and that extend to within thirty-six (36") inches of the floor. These assists shall have sufficient clearance from the barrier to prevent inadvertent wedging of a passenger's arm or hand. A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The front door assist shall be no less than thirty-six (36") inches above the floor or the average step tread surface. The assists at the front of the bus shall be arranged to permit a 5<sup>th</sup> percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the operator's barrier, wheel housings, or front modesty panel.

**5.56 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 seventy-two (72") inches above the floor. Overhead assists shall simultaneously support one hundred fifty (150) pounds on any twelve (12") inch length. No more than five (5%) percent of the full grip feature shall be lost due to assist supports.

Overhead handrails shall be provided which shall be continuous except for a gap at the rear doorway.

Handrails and stanchions shall be sufficient to permit safe boarding, on-board circulation, seating and standing assistance and alighting by persons with disabilities.

The vertical stanchion immediately behind the operator shall either terminate at the lower edge of the aisle-facing seats, if applicable, or be "dog-legged" so that the floor attachment does not impede or interfere with wheelchair footrests. If the operator's seat platform must be passed by a wheelchair or mobility aid user entering the vehicle, the platform, to the maximum extent practicable, shall not extend into the aisle or vestibule beyond the wheel housing.

The minimum interior height along the path from the lift to the securement location shall be seventy-two (72") inches.

A crash resulting in a one (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. Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. All components of the passenger assists including functional components shall be of anodized aluminum or stainless steel. Assists shall withstand a force of three hundred (300) pounds applied over a twelve (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 flush with the surface and free of rough edges.

#### **5.57 FRONT DOORWAY**

Front doors or the passenger entry area shall be fitted with ADA compliant assists. Assists shall be as far outward as practicable, but shall be no further than four (4") inches from the outside edge of lower step tread, shall provide a near vertical hand grip at the outer edge of the door, and shall be easily grasped by a 5<sup>th</sup> percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assists and the assists on the wheel housing or on the front modesty panel.

#### **5.58 LONGITUDINAL SEATS**

Longitudinal 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 practicable and shall be no more than fifty-two (52") inches apart or be functionally continuous for a 5<sup>th</sup> percentile female passenger. (The Configuration of assists will be reviewed and determined at the pre-production meeting with final configuration approved by MTS).

#### **5.59 ADDITIONAL VERTICAL ASSISTS**

Up to eight (8) vertical passenger assists shall be installed at the aisle side of forward facing seats from the seat grab handle to the overhead passenger assist. (The configuration of assists will be reviewed and determined at the pre-production meeting with final configuration approved by MTS).

## **PAINING AND LETTERING**

### **5.60 GENERAL PAINTING AND LETTERING**

Color numbers, color chips, locations, typeface, logo grid, drawings and specifications for all interior and exterior requirements will be furnished to the bus manufacturer at pre-production meeting.

### **5.61 EXTERIOR PAINT**

The exterior of the bus shall be painted with up to four metallic colors plus a clear coat and be of polyurethane paint which is baked dry (actual colors to be provided at the pre-production meeting). The bus manufacturer shall provide line drawings of the front, rear, driver's side and passenger side of the bus to MTS. MTS will assist in the layout of the individual colors and their locations for the manufacturer's name and number of the paints.

### **5.62 ROOFTOP NUMBERS**

1. There shall be up to a four digit rooftop number on each bus. Numbering shall be determined at the pre-production meeting.
2. All numbers shall be black decals; edge sealed and shall be block style.
3. Numbers shall be located either on rooftop canopy or on rooftop to rear of canopy and shall read from street-side to curbside centered across bus.
4. Numbers shall be minimum:
 

A.	Height:	30"
B.	Width:	16"
C.	Width of Print:	3"
D.	Space between numbers:	6"

### **5.63 LETTERING AND SIGNING-EXTERIOR**

All exterior markings shall be manufactured from 3M "Scotchlite" 580 series material, or approved equal. Light colored decals over dark paint and dark colored decals over light paint. All exterior decals, lettering, logos, and numbers shall be edge sealed. Colors of decals shall be determined at the pre-production meeting.

### **5.64 LOGOS**

All logo placement, colors, and sizes will be provided at the pre-production meeting.

### **5.65 NUMBERING**

Four (4) sets of four (4) numbers each, six (6") inches high shall be affixed to the exterior of the bus, one (1) set to each of four (4) locations as follows: On front of bus at top front curbside corner, over front door, over driver's window, and on rear of bus at upper street-side corner. Actual vehicle numbers shall be provided at the pre-production meeting.

**5.66 DISABLED SIGN**

Three (3) international symbols indicating wheelchair accessibility shall be applied, one (1) to the front, one (1) to the curbside, and one (1) to the rear.

**5.67 DECAL – FRONT**

Information will be provided at the pre-production meeting.

**5.68 DECAL – REAR**

Information will be provided at the pre-production meeting.

**5.69 KNEELING AND LIFT DESIGNATION**

The word "Kneeling" with an arrow pointed down and the word "Lift" shall be applied just rear of the front entrance and just rear of the rear exit door. Lettering shall be one (1") inch tall. Exact location will be specified by MTS.

**5.70 CALIFORNIA NUMBER DESIGNATION**

California Operator Identification numbers shall be applied to both sides toward the rear of the bus. Lettering shall be approximately two (2") inches tall by fourteen (14") inches long. Location shall be on lower skirt aft of rear axle. Actual number is operator distinctive and shall be provided at pre-production meeting.

**5.71 BATTERY DISCONNECT DECAL**

Decal shall be on the exterior of the battery access door and shall read "BATTERY DISCONNECT."

**5.72 AIR TANK DRAIN DECAL**

Decals indicating the location of all air tank drain valves shall be provided.

**5.73 INTERIOR PAINT**

The painted surfaces of the ceiling above the driver's compartment shall be painted with black acrylic enamel, matte finish and applied over a cleaned, primed surface.

The lower dash, inside of entrance and exit doors, windshield frame area, and instrument case shall be painted with semi-gloss black acrylic enamel applied over a cleaned and primed surface.

**5.74 LETTERING AND SIGNING - INTERIOR**

Markings shall be "Scotchcal" only, elastomeric, pigmented file, die-cut, pre-spaced, with pressure-sensitive adhesive. All marking materials shall be applied in strict conformance with the film manufacturer's recommendations as to surface preparation and application procedure. No hand lettering or stenciling shall be permitted.

Decals shall be furnished and installed by the bus manufacturer and must be in English and Spanish.

Vehicle Number - One (1) each, four (4) digit set of six (6") inch numbers on destination sign door.

**5.75 NO SMOKING**

No Smoking - No Eating - No Radio Playing on destination sign door.

**5.76 WHEELCHAIR RAMP OPERATING INSTRUCTIONS**

Wheelchair ramp operating instructions shall be provided in the operator's area pertaining to dash control buttons and switches. Wheelchair ramp operating instructions shall also be provided in the manual control operation compartment if bus is equipped with manual controls.

**5.77 PRIORITY SEATING SIGNS**

Contractor shall provide and install sign(s) which indicate that seats in the front of the vehicle are priority seats for persons with disabilities, and that other passengers are to make such seats available to those who wish to use them. At least one (1) set of forward-facing seats shall be so designated.

Each wheelchair or mobility aid securement location shall have a sign designating it as such.

Characters on signs required by this section 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 5/8" inch, 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 light-on-dark or dark-on-light.

**5.78 INTERNATIONAL SYMBOL**

One (1) International Wheelchair Lift symbol shall be applied immediately below the bottom of the window adjacent to each wheelchair securement location.

**5.79 REAR DOOR OPERATION**

Passenger rear door operating instructions shall be in English and Spanish to read as follows: (Caution! Stand clear door controlled by driver). Spanish to read as (Cuidado! mantenga distancia la puerta esta controlada por el conductor).

**5.80 VANDALISM/NO SMOKING**

Two (2) "Vandalism is a Crime" and "No Smoking" signs over rear longitudinal passenger seats and in the standee windows on both the curbside and roadside shall be provided.

**5.81 NO RADIOS/NO EATING**

Two (2) international symbols, "No Smoking/No Radios/No Eating" signs over rear longitudinal passenger seats (curbside and roadside) shall be provided.

**5.82 EMERGENCY ESCAPE HATCH INSTRUCTION**

Emergency escape hatch identification and operating instructions in Spanish and English shall be provided.

**5.83 RADIATOR FILL CAUTION**

Radiator fill door "caution" on inside of door shall be provided.

**5.84 EMERGENCY EXIT INSTRUCTIONS**

Emergency Exit and Window Release Lever operations instructions - MUST BE METAL and riveted to window frame rail within six (6") inches and adjacent to each release lever.

**5.85 WATCH YOUR STEP SIGN (PISE CON CUIDADO)**

"Watch Your Step" signs shall be installed at entrance door area, at exit door area, at the steps to the rear deck area. The exact locations will be specified by MTS. All bilingual signs are to be pre-approved before installation.

**CHASSIS SPECIFICATIONS****5.86 GENERAL CHASSIS SPECIFICATIONS**

This section, broadly titled "Chassis" details the requirements for primary and secondary (accessory) mechanical equipment of the transit bus.

**5.87 HYBRID PROPULSION SYSTEM (MTS PREFERED PROPULSION SYSTEM)**

The propulsion unit shall be located in the rear of the bus and shall be a CNG/Electric Hybrid series configuration utilizing the ISE Hybrid Drive System, or approved equal. Proposals shall also include pricing for an optional standard engine/transmission CNG propulsion system. Following are the minimum requirements for the series electric hybrid propulsion system.

The hybrid generator system shall include a CNG fueled engine and generator along with the required support systems assembled in a modular unit and cradle mounted in the rear of the bus. The engine shall be a Cummins B Gas Plus 5.9 liter six cylinder natural gas engine or approved equal. The engine shall have a minimum of 230 HP @2800 RPM and peak torque of 500 LB-FT @ 1600 RPM. The engine configuration shall comply with California Air Resources Board low-NOx+NMHC standard of 1.8 g/bhp-hr and low particulate matter standards. Total engine displacement shall be 359 cubic inches and the engine compression ratio shall be 10.5:1. The generator shall be a Siemens 165 kW liquid cooled unit or approved equal.

The propulsion motor configuration shall include two (2) Siemens 85 kW continuous duty motors, or approved equal that will propel the bus through a Flenders combining gearbox, or approved equal. The propulsion motors shall be based on the ELFA dual motor and controller system as manufactured by Siemens AG, or approved equal. The motors in combination shall have a power rating of 170 kW (228 HP) continuous and 288 kW (386 HP) peak. The combining gearbox shall accommodate 2 AC motor inputs and a peak input torque of 2 x 332 ft-lb. Output torque peak shall be 2656 ft-lb. Maximum input speed shall be 10,000 RPM with a drive ratio of 4.05.

Twin Siemens ELFA inverters shall be provided. Each inverter module is to contain two 120 kW (161 HP) inverters. Power to the inverters is to be provided by the generator. One inverter will be configured to provide 230 VAC for all electrically driven accessories and will provide AC power to one of the Siemens propulsion motors. The second inverter shall provide DC power from the generator and provide AC power to the second Siemens propulsion motor. The inverters also provide the switching for the battery energy storage system and the braking resistors.

The energy storage subsystem shall be based on the Cobasys Nickel Metal Hydride battery pack, or approved equal. Should testing indicate that an ultracapacitor pack is required then a properly rated unit shall be provided. The energy storage subsystem shall provide for power demands beyond the output of the generator system. In addition, the energy storage system shall provide energy recapture during regenerative braking opportunities presented during bus operation (coasting and deceleration).

Regenerative braking shall be provided to maximize kinetic energy capture for the energy storage subsystem. Transitions between the hybrid regenerative braking system and bus air system braking shall be accomplished smoothly with no perceptible lurching by the bus. Blending of the regenerative braking and bus brake system shall be provided automatically and shall be fail safe in design. Brake resistors shall be provided and adequately sized to bleed off excess braking energy should the energy storage subsystem be full or the desired level of regenerative power exceed the level that the energy storage subsystem can accept. The regenerative braking system shall be cut out in the event of a vehicle ABS event.

Hybrid system controls shall be provided by the vehicle controller working on a high speed automotive J1939 multiplexing system. Bus architecture shall be provided by the Controller Area Network or CAN controller. All subcomponent communications will take place on a single CAN network to optimize energy management and provide the overall control of the hybrid system.

An electrically driven hydraulic pump for power steering and air compressor for the braking system shall be provided. These accessories shall operate on 230 VAC. The HVAC system shall also be powered by 230 VAC. High temperature cooling system shall be provided to cool the CNG engine and the braking resistors. The conventional heat exchanger location on the rear street side of the bus shall be used for the hybrid generator CNG engine charge air cooler. The CNG engine cooling radiator and electric fans shall be roof mounted. Air flow for the charge air cooler and the hybrid engine cooling radiator shall be provided by proportionally temperature controlled electric fans.

The low temperature cooling system shall provide cooling for the vehicle electric drive components including: generator, inverters and motors; and shall be roof mounted with electric cooling fans that are proportionally temperature controlled.

Provisions shall be made to permit the introduction of shop power supply to permit routine maintenance of the vehicle. The connection point shall be non-metallic and watertight. Location shall be determined during the pre-production meeting but shall be at least twenty-four (24") inches above the street surface.

Engine compartment shall be equipped with five (5) service lamps Dialight 17081CB, or approved equal. The lamps shall be positioned for optimal lighting throughout the hybrid engine compartment to aid in servicing of engine and generator components.

#### **5.88 STANDARD CNG ENGINE (OPTIONAL)**

The engine shall be an electronically controlled Cummins ISL-G 8.9 Liter CNG engine with 280 bhp and 900 lb-ft of torque. The engine shall meet or exceed all EPA and/or any other emissions requirements for engines in force at the time of manufacture when operating on fuel equal to CARB Specifications for Compressed Natural Gas #2292.5.

The engine and transmission shall be designed to mount into the bus aligned in a "T" drive configuration.

Specifications for engine electronic controls shall include a full-load idle speed of 600 RPM, a fast-idle speed of 1000 RPM, and a maximum engine speed governed at 2200 RPM. The engine shall incorporate electronic controls capable of transmitting and receiving electronic inputs and data from other drive train components and broadcasting that data to other vehicle systems. Communication between electronic drive train components and other vehicle systems shall communicate data using a combination of SAE Communication Protocols J1939 and/or J1708/J1587. Electronic controls shall be compatible with either 12 or 24 volt power distribution and compensate for changing conditions such as variations in vehicle weight and engine power. The electronically controlled engine shall have on-board diagnostic capabilities, be able to monitor functions, store and time stamp out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. The engine shall contain built-in protection software to guard against severe damage. A diagnostic reader device and/or laptop computer connector port, suitably protected against dirt and moisture, shall be provided in the operator's area. The on-board diagnostic system shall trigger a visual alarm to the operator when the electronic control unit detects a malfunction.

Accelerator system shall be Williams consistent with transmission/engine, or approved equal. The throttle pedal shall be mounted so that it is equal to or higher than brake pedal height.

A Morse speed control, or approved equal, shall be provided in the engine compartment for operation of the engine from the engine compartment from idle to maximum no load speed. The Morse speed control shall only operate with the transmission in neutral and the rear run switch in the rear run position.

Throttle controls shall be disabled while the bus brake interlock is activated. Use of the fast-idle function shall activate the bus brake interlock system. The fast-idle shall interface with the bus brake interlock system in such a way as not to allow the fast-idle or brake interlock to activate while the transmission is in any drive range.

The engine shall incorporate an engine coolant temperature sensor, separate from electronic controls, set at two hundred fifteen (215°) degrees Fahrenheit connected to an "ENG TEMP" or "COOLANT TEMP" warning indicator lamp located on the dash.

The engine shall incorporate an oil pressure sensor separate from electronic controls, linked to a "LOW OIL PRESS" warning indicator lamp located on the dash.

All engine accessories, including air compressor, alternator, hydraulic pump, power steering pump, fan motor, air conditioning compressor, and engine oil cooler, are to be readily accessible and able to be serviced without removal of engine mounts or supports.

Provision shall be made for easy access to the engine spark plugs. The flywheel end of the engine shall be accessible from the interior of the bus through a large opening behind and under the rear seat.

The engine and transmission shall have the ability to be installed and removed as a complete unit or as individual components. Engine and transmission mounts shall be made from a combination of steel and rubber material and be arranged to provide convenient accessibility for service.

All fluid and air lines shall have connectors at the engine compartment bulkhead so as to provide for efficient service or replacement.

Engine compartment electronic control wire harnesses shall be made using heat resistant wire and shall be protected in high temperature sheathing or split loom. All wire harness connectors shall be moisture and corrosion resistant Packard Weather Pac, or approved equal.

All wire harness connectors and splices that interface engine and/or transmission electronic controls with bus wiring shall be engine and/or transmission manufacturer specified or approved. A diagnostic connector for Cummins Engine and ZF Transmission shall be provided in driver's compartment and engine compartment.

All engine exhaust piping from turbocharger outlet up to the bottom of muffler shall incorporate rigid metal composite insulation shielding as manufactured by InsulTech, LLC, or approved equal, to reduce engine compartment temperatures.

The starter shall be a Delco Remy MT39 electric starter or approved equal.

A dry type air cleaner, Nelson with restriction indicator, or approved equal shall be used. The air intake duct shall be so shaped as to eliminate water entrance into the air induction system. A passage shall be provided so that any water finding entry will drain prior to induction into the engine. The air cleaner shall be mounted to permit easy access for filter maintenance. An easily visible glass air filter service indicator shall be provided in the engine compartment.

All engine accessories shall be driven directly from the engine without the use of drive belts except for the air conditioning compressor and generator. Water pump may also be belt driven.

Belts shall be serpentine type belts, with the exception of air conditioning compressor belt, which may be installed in power band set as manufactured by Gates or Goodyear, or approved equal. In addition an idler pulley or belt tensioner will be installed to reduce vibration on belts if necessary whether a Thermo King or Carrier unit is used.

All hoses (air, coolant, fuel, engine oil, transmission fluid and hydraulic fluid) in the engine compartment, excluding high pressure hoses, shall be Aeroquip FC300, FC350, FC510 or 2807 hose, or approved equal, with stainless steel crimped fittings, where pressures and/or temperatures permit, and shall have standard JIC stainless steel, swivel end fittings. They shall be routed or shielded so that failure of a hose shall not allow hydraulic fluid or oil to spray or drain onto any component operable above the auto ignition temperature of the fluid. Hoses shall be individually supported and shall not touch one another or any part of the bus.

Engine coolant hoses not utilizing threaded end fittings shall be of a silicone type. All hose clamps shall be stainless steel, sleeved and a constant torque type, Breeze or approved equal. All power steering and hydraulic pump discharge hoses shall be "hi-impulse" hose with crimped stainless steel fittings.

Engine shall be equipped with Probalizer, or approved equal, oil sample fittings. Oil sample fitting shall be installed in a location that is conveniently accessible to service personnel.

Engine compartment shall be equipped with five (5) service lamps Dialight 17081CB, or approved equal. The lamps shall be positioned for optimal lighting throughout engine compartment to aid in servicing of engine components.

#### **5.89 TRANSMISSION (FOR STANDARD CNG OPTION)**

The transmission shall be a ZF 6HP594, 6-speed with integral input retarder, or approved equal. Gross input power, gross input torque, and rated input speed shall be compatible with the engine. Transmission shall be mounted in a way to allow easy removal without having to remove or move the engine. A mechanic, with optional assistance, shall be able to remove and replace the transmission assembly for service in less than sixteen (16) total combined man-hours. The transmission shall be designed to operate for not less than 300,000 miles without replacement or major service.

The transmission shall incorporate electronic controls capable of transmitting and receiving electronic inputs and data from other drive train components and broadcasting that data to other vehicle systems. Communication between electronic drive train components and other vehicle systems shall communicate data using SAE Communication Protocols J1939. Electronic controls shall be compatible with either 12 or 24 volt power distribution, provide consistent shift quality, and compensate for changing conditions such as variations in vehicle weight and engine power. The electronically controlled transmission shall have on-board diagnostic capabilities, be able to monitor functions, store and time stamp out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. The transmission shall contain built-in protection software to guard against severe damage. A diagnostic reader device and/or laptop computer connector port, suitably protected against dirt and moisture, shall be provided in the operator's area. The on-board diagnostic system shall trigger a visual alarm to the operator when the electronic control unit detects a malfunction.

The transmission shall be equipped with an integral input hydraulic retarder designed to extend brake lining service life. Hydraulic fluid should flow continuously from the retarder directly to the oil cooler during the retarder cycle. The application of the retarder shall become partially engaged ( $\frac{1}{3}$  of its total application) when the throttle is completely released (zero throttle). Maximum retarder shall be achieved when brake pedal is depressed ( $\frac{2}{3}$  of total at 1 psi brake application pressure and full retarder engagement at 5 psi brake application). Brake lights shall illuminate when the retarder is activated.

The transmission shall have an auto neutral feature that shall cause it to automatically and immediately shift to "Neutral" whenever the transmission is left in gear and the parking brake is applied. This system shall also automatically shift the transmission to "Neutral," after a 5-minute delay, whenever the exit door brake interlock is applied.

A brake pedal application of 15 to 20 per square inch (psi) shall be required by the operator to engage forward or reverse range from the neutral position to prevent sudden acceleration of the bus from a parked position.

#### **5.90 SERVICE COMPONENTS**

The engine oil filler tube and dipstick shall be mounted in the engine compartment and be accessible through the engine compartment door. Engine oil dipstick shall have measurements with engine running and stopped.

The transmission (if equipped) filler tube and dipstick shall be located in the engine compartment and be accessible through the engine compartment door.

The engine oil pan drain plug and the transmission (if equipped) oil pan drain plug shall be a magnetic type, located in such a way as to provide for easy service access.

#### **5.91 EXHAUST SYSTEM**

The exhaust system and tailpipe assembly shall be routed upward through the engine compartment and out at the roof-line on the street-side of the bus. Exhaust stack (tailpipe) will be pointed straight back and be of sufficient height to prevent exhaust gases and waste heat from discoloring or causing heat deformation to the bus. There

shall be at least a two (2") inch gap between the roof fiberglass and exhaust tailpipe to prevent possible fires. The exhaust system shall be adequately shielded to prevent heat damage to any bus component. All exhaust piping from the turbocharger outlet up to the bottom of muffler shall incorporate rigid metal composite insulation shielding as manufactured by InsulTech, LLC, or approved equal, to reduce engine compartment temperatures.

The muffler shall be manufactured by Nelson, or approved equal. Exhaust tubing and tailpipe shall be heavy gauge corrosion resistant steel.

The use of vertical exhaust shall not increase the overall length or height of the vehicle. The engine compartment, including the exhaust duct plenum shall be completely sealed to prevent smoke or fumes from entering the bus interior.

#### **5.92 COOLING SYSTEM (FOR STANDARD CNG OPTION)**

Temperature of operating fluids on the bus shall be controlled by a cooling system. The cooling system shall be sized to maintain the engine and/or the top radiator tank temperature at less than two hundred five (205°) degrees F during the most severe operations possible with the bus loaded to GVWR and with ambient temperatures up to one hundred twenty (120°) degrees F.

The Contractor shall demonstrate compliance with this requirement on the first bus prior to shipment to MTS.

A thermostatically controlled hydraulically driven fan shall be provided and be effectively power driven only at engine temperatures in excess of one hundred eighty-five (185°) degrees. The fan shall be of the variable speed design incrementally increasing fan speed as engine temperature increases. Fan shall reach maximum speed when engine coolant temperature reaches one hundred ninety-five (195°) degrees F.

The hydraulic system reservoir sight glass and fill cap shall be accessible from engine compartment door. Reservoir shall be equipped with a low fluid sensor, which shall activate an indicator light on the operator's instrument panel if reservoir is low on fluid. Hydraulic system shall also incorporate a filtering system with differential pressure gauge.

The radiator shall be located to the left rear of the bus. It shall have stainless steel top and bottom tanks with welded inlet and outlet necks.

All cooling system pipes, necks and stems where cooling system hoses are attached shall have a raised lip to keep the hose and clamp from slipping off under pressure.

Electric controls for cooling fan operation shall be designed so that any electrical failure will result in the fan running at maximum rpm.

The radiator surge tank shall be mounted above the radiator. The surge tank shall be made from stainless steel and equipped with a safety type filler cap, and an AC 861127 automatic pressure relief cap, or approved equal. Surge tank shall have only one (1) sight glass at the full mark, visible from the filler cap service door.

Access to the surge tank filler cap shall be through a spring loaded service door. Door size is to be determined at the pre-production meeting and located on the left side near the rear of the bus.

An engine coolant filtering system shall be included. The filter shall contain a time released coolant conditioner. The filter may be remote chassis mounted for easy service access.

## **CNG FUEL SYSTEM**

### **5.93 GENERAL CNG FUEL SYSTEM**

The fuel system provided shall be a CNG system capable of providing a minimum of 450 miles between refueling. The fueling system shall be capable of providing a maximum cylinder pressure of 3,600 psi @ seventy (70°) degrees F, at a delivery rate from 750 cubic feet per minute (CFM) to 950 CFM.

The fuel system shall be designed to the minimum regulations and/or standards for safety, quality, reliability and longevity of FMVSS, DOT, Title 13, National Fire Protection Agency (NFPA) 52, American Society of Mechanical Engineers (ASME), ASTM, SAE, Compress Gas Association (CGA), American Gas Association (AGA), Code of Federal Regulations (C.F.R.) and Underwriters Laboratories (UL). Where a conflict exists, statute, code or regulation shall take precedence over guidelines or recommended practice. In the absence of a statute, code or regulation, the documented guidelines or recommended practice shall apply.

For the purpose of this section, fuel system includes fuel cylinders, their mounting, lines, tubing, regulators, valves, controls, methane gas detection systems, fire suppression systems, ventilation and any electrical directly or indirectly affected by the CNG installation.

Prior to and after production the Contractor shall demonstrate compliance with all of the above referenced statutes, codes, guidelines or recommended practices.

### **5.94 FUEL CYLINDERS**

Fuel supply shall provide approximately four hundred fifty (450) miles driving range at the agencies operating profiles between refueling at 3,600 PSI.

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

Fuel cylinders shall be a composite of carbon and glass fibers as manufactured by Lincoln Composites, or approved equal. The cylinders shall be certified for a minimum useful life of fifteen to twenty (15 to 20) years and shall not require re-certification for the full fifteen to twenty (15 to 20) year period. Fuel cylinders shall be certified to NGV's most current standards.

Fuel cylinders shall be constructed and inspected in accordance with the above referenced statues, codes, regulations, guidelines and recommended practices. Cylinders, valves and relief device lines shall be properly marked or labeled as required.

Fuel cylinders shall be roof mounted. The cylinders shall be hidden from view in an aero-dynamic enclosure. Design and style of roof enclosure is subject to approval by MTS.

Buses with roof mounted cylinders shall be required to demonstrate, before and after production, utilizing the procedures for testing, handling and stability included in the SAE Technical Paper Series 861950, First Article Bus Testing, handling and stability, which includes steady rate cornering and over-steer, transient cornering and obstacle avoidance. Standards shall be comparable to buses with non-roof mounted cylinders, or corrected to acceptable safe standards.

Buses with roof-mounted cylinders and hybrid roof mounted components require a non-skid walkway in front, behind, and on top of the cylinder enclosure and the hybrid roof mounted components. The non-skid material shall be edge sealed. Front and rear ends of enclosure shall incorporate a step fabricated into enclosure end caps.

#### **5.95 MANUAL SHUT-OFF VALVE**

A UL listed manual shut-off valve shall be provided and installed and identified on the exterior of the bus with a decal indicating: "MANUAL SHUT-OFF VALVE." It is preferred that the shut-off valve be located near the CNG fuel fill valve. Valve shall be located within a person's reach at ground level.

#### **5.96 AUTOMATIC SHUT-OFF VALVE**

A UL listed automatic shut-off valve shall be provided and installed. The automatic shut-off valve shall be identified with a decal mounted on the bus exterior labeled "AUTOMATIC SHUT-OFF VALVE." The automatic shut-off valve shall be normally closed and held open by electrical power. The valve shall be wired so it shuts off when the run switch is in the off or accessory positions, when engine vacuum is not present, or a methane gas or fire fault is detected. Location shall be adjacent to the manual shut-off valve.

#### **5.97 FUEL FILLER FITTING**

The fuel filler receptacle fittings shall be located at the curbside rear of the bus aft of the rear door. Contractor shall provide and install both Sherex Series 3600 and 5000 type fuel receivers, or approved equal, at the fueling location. Receptacles shall be compatible with Series 1000 and 5000 Sherex Series nozzles and be equipped with dust caps. The access door for fuel receivers shall be interlocked to the hybrid generator engine to prevent the engine from being operated or started while fuel door is not latched. If fuel fill access door is opened while the hybrid generator engine is running, the hybrid generator engine shall shutdown after a fifteen (:15) second delay. The exterior of the filler door shall be labeled in one (1") inch high letters, "FOR CNG ONLY." Exact location shall be approved by MTS.

**5.98 FUEL LINES**

Buses manufactured under this contract shall be manufactured in compliance with NFPA-52 for United States manufactured buses and Canadian Compressed Gas Association (CAN/CGA)-B149.4-M91 for Canadian manufactured buses. All tubing shall be a minimum of seamless Type 304 stainless steel (ASTMA269 or equivalent). Fuel lines and fittings shall not be fabricated from cast iron, galvanized pipe, aluminum, plastic, or copper alloy. Pipe fittings and hoses shall be clear and free from cuttings, burrs or scale. Pipe thread joining material that is impervious to CNG shall be utilized as required.

Fuel lines shall be securely mounted, braced and supported every twenty-four (24") inches, or as designed by the bus manufacturer to minimize vibration, and shall be protected against damage, corrosion, or breakage due to strain or wear.

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

Fuel hose and hose connections, where permitted, shall be less than forty-eight (48") inches in length, made from materials resistant to corrosion and action of natural gas, and protected from fretting and high heat.

High pressure CNG lines shall be pressure tested to a minimum of one hundred twenty-five (125%) percent of system working pressure prior to fueling. Nitrogen shall be used to pressure test the fuel lines/assembly. The bus manufacturer shall have a documented procedure of testing the high pressure line assembly. Fuel lines from Sherex valves to cylinders shall be one (1") inch inside dimension (ID), minimum.

**5.99 FUEL UNLOADING**

A provision shall be provided to unload all of the fuel from the storage cylinders to a facility based low pressure gas line or storage facility. Connection shall be accessible at the fueling fitting area and be properly protected and labeled. It shall be possible to unload a full load of fuel in thirty (30) minutes or less.

**5.100 FIRE SUPPRESSION AND GAS DETECTION SYSTEM**

Automatic Fire Sensing and Suppression (AFSS)

**General Requirements:** An Automatic Fire Sensing and Suppression System (AFSS) complete with optical infrared fire sensors, control panel, vehicle interface, and extinguishing system shall be provided for the engine compartment.

**AC Compartment:** A separate detection only system consisting of two (2) Optical Infrared Detectors shall be provided for the AC Compartment.

**AFSS Operation:** Upon detection of a fire the protection panel shall alert the operator with visual and audible signals and then initiate automatic engine shutdown, extinguisher discharge, and related sequences.

**Supervision Monitoring:** Upon loss of continuity of the detection or suppression circuits, the protection panel shall provide a visual and unique audible alarm.

**Control Panel:** The control panel shall be located within view of the driver/operator, but shall not impede his view of the road. A single connection interface shall be provided to interface to the AFSS harness.

**The protection panel shall incorporate the following driver/operator controls:**

- A) Alarm Silence
- B) Visual and audible alarm TEST switch
- C) Delay engine stop/extinguisher discharge
- D) Reset

The protection panel shall provide fifteen (:15) second time delay prior to discharging the extinguisher and sending signal to shut the hybrid propulsion engine down.

**Manual Discharge Switch:** A Manual Discharge switch shall be provided within easy reach of the operator. The switch shall be protected against inadvertent activation by means of a protective guard held in place by a tamper seal. The control panel shall indicate a Manual Discharge event with a unique visual display that cannot be reset by the operator. Activation of the manual discharge switch shall immediately discharge the extinguisher(s) and send a signal for hybrid propulsion engine shutdown.

**Fire Detection:** Two (2) Optical Infrared Fire Detectors shall be located in the hybrid engine/generator compartment and two (2) in the A/C compartment to view major fire sources. The system shall also incorporate two spot sensors in the hybrid engine/generator compartment, one of which shall be located near the base of the muffler. The bus manufacturer and the AFSS manufacturer shall determine location and temperature of sensors. The detection system shall be compatible with infrared optical detection, linear thermal detection or spot thermal detection used independently or in any combination.

The optical flame sensor shall be dual spectrum infrared with at least a ninety (90°) degree conical field-of-view. The optical sensor shall respond to an explosive fuel fire in less than one-half (½) of one (:01) second. The sensors shall be immune to typical false alarm sources found on transit buses. Each sensor shall be equipped with a status LED to indicate power on and alarm conditions.

**Fire Suppression:** The pre-engineered fire extinguishing system shall consist of extinguisher(s), nozzle(s) (minimum of four nozzles) and a distribution system designed for vehicle applications that shall be installed in accordance with the AFSS manufacturer installation manual.

**Extinguisher:** The extinguisher shall be of the stored pressure type and consist of a valve and DOT approved cylinder. The extinguisher shall be charged with a minimum of twenty-five (25) pounds of BC rated Purple K pressurized to a minimum of 350 psi. The valve shall incorporate a pressure gauge and shall not require the attachment of other devices such as a control head for operation. Provisions shall be provided on the extinguisher bracket or other suitable location to stow the anti-recoil cap and/or other devices used to ensure safe transportation of the extinguisher when removed from the bus.

**Electrical Requirements - Input Voltage:** The system shall operate with a 12 VDC or 24 VDC supply. The system shall be compatible with SAE Recommended Practice J1455. The AFSS shall not require more than 2.4 W (0.1 A @ 24 VDC, 0.2A @ 12 VDC) of electrical power to operate.

**Harness:** The harness shall be easily maintained and repaired by a 3M mechanic using standard hand tools. Only commonly available wires and connectors shall be required.

**Acceptance Tests:** The completed system shall be tested and certified by the AFSS system supplier. The test shall determine that the system has been properly installed and shall function as intended. A Certification Report shall be provided that includes a detail of the tests performed. A service representative shall be on MTS property for the inspection of the systems as soon as the first bus arrives.

### **Combustible Gas Leak Detection System - General Requirements**

**General Requirements:** A Combustible Gas Leak Detection system shall be provided to monitor the hybrid engine/generator compartment, A/C compartment and each separate fuel storage area(s), and shall automatically activate audible and visual alarms in the operator's area for two (2) levels, trace and significant of the lower explosive limit (LEL) of natural gas (methane). The system shall be compatible with the control panel for the AFSS and shall not require separate interfaces or control panels.

The bus shall have a total of five (5) gas detectors. These will detect a gas leak and have a sensitivity of fifteen to twenty (15% - 20%) percent of the LEL for methane (natural gas). The LEL for methane is five (5%) and the upper explosive limit is fifteen (15%) by volume of air. The vapor density is .06 and therefore lighter than air. The ignition temperature is nine hundred ninety-nine (999°) degrees F. (630 degrees C). The detectors are located as follows:

- Two (2) ea. in the roof mounted fuel storage bay.
- One (1) ea. in the A/C compartment.
- Two (2) ea. in the hybrid engine/generator compartment.

The detectors shall have an LED on them to indicate the status of the unit, a green light indicates the detectors are functioning and no gas is detected and a red light indicates that gas has been detected or it is not functioning correctly. If this happens a red light labeled "gas detection system warning" shall light and a buzzer shall sound. If the ignition system is in the "Off" position, the operator's horns shall also cycle to alert maintenance personnel. There shall also be a green light on the operator's dash panel labeled "gas detection system on", to indicate that power is provided to the gas detection system.

**Combustible Gas Sensor:** The CGS sensor shall be the metal oxide type and shall not require calibration. The sensor element shall be enclosed in a chamber specifically designed to minimize typical contaminants such as oil mist, water, cleaning fluids and other contaminants that may poison or shorten the life of the sensor. The sensor element shall be field replaceable without special tools. Each sensor shall incorporate a bi-color status LED to indicate Power, Trace Alarm, Significant Alarm and Element Failure.

**Trace Gas:** Upon detection of a trace gas (20% LEL), the effected sensor LED and protection panel "Gas Leak" LED shall flash red.

**Significant Gas:** Upon detection of a significant gas (50% LEL) the affected sensor and protection panel "Gas Leak" LED shall remain on steady red and the protection panel audible (silenceable) alarm shall sound. The sensor LED shall latch to enable easy location of leaks by maintenance crews.

Upon loss of continuity or sensor element failure the sensor LED will alternate red/green and the protection panel "Gas Trouble" lamp will illuminate.

**AUDIBLE WARNING:** The circuit monitor shall also be equipped with a continuous tone audible alarm. This alarm shall sound in GAS, FIRE and FAULT conditions. Once the audible alarm begins to sound it shall be capable of being silenced by depressing a labeled ALARM SILENCE button, provided on the circuit monitor front panel. Indication of a silenced alarm shall be provided via a labeled SILENCED ENGAGED LED.

#### **5.101 AIR SYSTEM (AS APPLICABLE FOR PROPULSION SYSTEM)**

The bus air system shall operate all accessories and the braking system with reserve capacity. The system shall have the ability to charge the air system from 40 psi to the governor cut-off pressure of 125 psi in less than three minutes. Bus air system shall not leak down more than 5 psi as indicated on the instrument panel mounted air gauges, within fifteen (15) minutes from the point of governor cut-off.

The air compressor shall have a capacity of not less than 15.5 CFM at 1250 RPM and shall be a Wabco air compressor, or approved equal. The compressor shall be engine mounted and be gear driven. Air for the compressor shall be filtered through the main engine air cleaner system.

The air pressure governor shall be a Bendix-Westinghouse D-2 type, or approved equal, and adjusted at 125 psi cut-out pressure. The air governor shall be remote mounted for ease of access.

The pressure relief valve and the muffler tank will be mounted relative to the air compressor discharge port. Muffler tank drain valve will be remote mounted to discharge below the engine cradle level and be accessible from curbside lower skirt.

The main air supply line from the air compressor to the bus shall be Teflon® lined flexible steel braided line. Air lines except necessary flexible lines will conform to the installation and material requirements of SAE J844-type 3B for nylon if not subject to temperatures over two hundred (200°) degrees F. Nylon tubing shall be installed in accordance with the following color-coding standards:

- Green Line: Primary Brakes and Supply
- Red Line: Secondary Brakes
- Brown Line: Parking Brake
- Yellow Line: Compressor Governor Signal
- Black Line: Accessories
- Blue Line: Suspension

Nylon lines may be grouped and shall be continuously supported in an approved conduit.

All air lines shall be sloped toward a reservoir and routed to prevent water traps.

Air system reservoirs shall be centrally located. This system shall consist of:

- One (1) Supply Tank: Minimum 1800 cu. in.
- One (1) Accessory Tank: Minimum 1800 cu. in.
- One (1) Primary Tank: Minimum 1800 cu. in.
- One (1) Secondary Tank: Minimum 1800 cu. in.

Total air tank capacity shall be a minimum of: 7,200 cu. in.

All tanks shall be clearly marked as to what function they supply.

All tank drain valves shall have means to drain moisture below engine cradle level.

A Bendix AD-9, or approved equal, with muffler shall be provided to prevent the accumulation of moisture in the air system. The air dryer shall be vertically mounted with an easily replaceable desiccant cartridge. The air dryer shall have a purge and drain cycle and be changeable through the bottom of the dryer. The main air line check valve located between the air compressor and the first reservoir shall be accessible for maintenance. Means shall be provided to verify the check valve to be in working order. A towing and shop air line connector shall be installed on the front end of the bus to provide an air supply from external sources. A shop air line connector shall also be provided in the engine compartment and shall be labeled "BUS AIR." The air tap shall be of the quick disconnect type mounted in a ¼" inch pipe fitting.

## **5.102 BRAKE COMPONENTS**

The air brake application valve shall be a Bendix-Westinghouse E-10 treadle type. The rear brake relay valves shall be Bendix-Westinghouse R-14's and the front brake relay valve shall be a Bendix-Westinghouse R-12. The bus manufacturer shall specify details of the brake controls.

Brake actuator chambers shall be piston type MGM with E-Stroke brake monitoring system, or approved equal. The front actuator size shall be twenty (20") sq. inches. The rear service brake actuator size shall be a minimum thirty (30") sq. inches. The spring brake chambers shall also be a minimum of thirty (30") sq. inches. Slack adjusters shall be Haldex, or approved equal, automatic adjusting slack adjusters.

Brake stroke of each brake actuator shall be monitored electronically inside the actuator. Excessive stroke or failure to fully retract of any brake actuator shall cause a "Brake Fault" light on the diagnostic indicator lamp panel to illuminate.

Setting of the parking brake shall be signaled by illumination of the "Brake" light on the diagnostic indicator lamp panel. Illumination of the light shall confirm proper movement of both brake actuators, not just movement of the control. Similarly the lamp shall remain illuminated until the parking brake actuators are fully retracted after the control to release the parking brake is actuated.

**5.103 SUSPENSION**

The bus shall be equipped with an air-suspension system. Air suspension system shall consist of four (4) rear and two (2) front air springs and three (3) leveling valves as manufactured by Barksdale, or approved equal, by which the air pressure is automatically regulated in proportion to the bus loading.

The air springs or bellows shall have a nominal working height of eleven and one-half (11½") inches. Air bellows shall be Firestone, or approved equal, twelve and one-half (12½") inch diameter and are to be fabricated from two-ply weather resistant natural rubber reinforced with nylon tire-grade fabric. Metal parts of the bellows shall be cadmium plated with zinc chromate sealer to prevent corrosion. Bellows shall be mounted to provide easy replacement under the bus.

The suspension system shall include one (1) front and two (2) rear height control valves by which air pressure is automatically regulated to the bellows in proportion to bus load.

The shock absorbers shall be dual action, telescoping type, heavy duty KONI shocks, or approved equal.

Radius and lateral rods shall be used to control torsional, lateral and pitching movements. Radius and lateral rod bushings shall be rubber and be of the replaceable type.

The bus manufacturer shall provide a description of the major suspension components and source of manufacture.

No parts may be used which are not in conformance with Federal and applicable State Safety Standards.

**5.104 FRONT AXLE**

The front axle shall be a MAN V8-65L with GAWR of 14,770 lbs. (one piece) type that is adequate for the bus loaded GVWR, or approved equal. The front axle shall be hub mounting type equipped with grease type front wheel bearings and seals.

Adjustable stop screws at each axle center end shall be provided to adjust bus minimum turn angle and prevent tire interference with adjacent parts.

**5.105 REAR AXLE**

The rear axle shall be a MAN 5.33:1, HP-1352-B with GAWR of 28,660 lbs., or approved equal. The rear axle shall be hub mounting type equipped with oil type wheel bearings and seals.

The differential gear ratio combined with the Flenders combining gearbox and the hybrid propulsion motors shall provide for a maximum highway speed of 65 MPH and a minimum highway speed of 60 MPH on level ground, and a minimum of 10 MPH on a twenty-two (22%) percent grade.

Acceleration shall meet the requirements below and shall be sufficiently gradual and smooth to prevent throwing standing passengers off balance. Acceleration measurement shall commence when accelerator pedal is depressed from an idle start.

SPEED (MPH)	TIME (SEC)
10	5.6
20	11.0
30	20.0
40	31.0

The differential assembly, drive pinion and pinion cage shall be mounted in a differential carrier which can be removed as a complete unit from the axle housing. The rear axle spindle tubes shall be pressed into the housing.

Shot-peened differential ring and pinion gears compatible with the use of a hybrid propulsion system shall be installed.

A drive shaft loop shall be provided to guard bus components and passengers from injury in the event of drive shaft failure.

Drive axles shall be full floating externally splined. Axles shall be compatible with the drive hub.

Rear wheel drive hubs shall ride on two (2) opposing tapered roller bearings mounted in the drive hubs.

#### **5.106 HUBOMETER TRIP RECORDERS**

Each bus shall be equipped with a Stemco, or approved equal, hub mounted trip recorder suitable for mounting on a transit bus. Hubometer shall be manual type mounted on curbside rear wheel and shall record miles to 1/10<sup>th</sup> of a mile.

#### **5.107 POWER STEERING (AS APPLICABLE FOR PROPULSION SYSTEM)**

Fatigue life of all steering components will exceed 250,000 miles. No element of the steering system will fail before suspension system components when one of the tires strikes a severe road hazard. Inadvertent alterations of steering as a result of striking road hazards are steering failures.

The turning radius shall not exceed forty-four (44') feet at seated load weight.

The tilt steering wheel will not be less than twenty (20") inches in diameter and will be shaped for firm grip with comfort for long periods of time and be non-padded. The steering column will be equipped with a telescopic adjustment of three (3") inches to allow the operator to adjust the location of steering for maximum comfort. The steering column shall tilt forward and backward six (6") inches for operator's comfort.

Hydraulically-assisted power steering shall be provided. The steering system shall be an integral type of American manufacture with rigid stainless steel lines. Steering gear shall be Sheppard M110 gear ratio 23:1, or approved equal, and shall be frame mounted and provide easy access for all adjustments.

An engine mounted, vane type hydraulic fluid pump, Luk or approved equal shall supply hydraulic pressure for the power steering system. A separate gear driven hydraulic pump shall be used to run the cooling system fan motor. This system is to use a one hundred eighty-five (185°) degrees F fan switch to control the operation of the fan motor "soft start" (switching) valve. The system is to be designed so that the lack of electrical power shall cause the fan to run at full speed, except in the case of fire.

The hydraulic system shall use Dexron III type hydraulic fluid. A hydraulic reservoir shall be provided with a filter, one sightglass and a dipstick. The reservoir shall be mounted in such a way as to provide easy service access and shall be accessible from the engine compartment door.

A stacked hydraulic system oil cooler shall also be provided, mounted outboard of the main engine radiator or be an integral part of the radiator/cooling system package.

#### **5.108 WHEELS**

Wheels shall be tubeless, Alcoa, part number 885553DB, or approved equal, aluminum forged disc, hub-piloted 10-stud type, with a Dura-Bright® polished finish on both sides. Wheel size shall be 22.5" x 8.25". One (1) spare wheel shall be furnished for each bus.

#### **5.109 TIRES**

Tires shall be Michelin, or approved equal, 305 - 70R x 22.5". One (1) spare tire shall be furnished for each bus.

### **ELECTRICAL**

#### **5.110 GENERAL ELECTRICAL**

The bus electrical system shall incorporate a Vansco, or approved equal, Programmable Logic Controller (PLC) processor, a multiplex wiring system suitable for controlling most vehicle functions with the exception of the engine, generator, propulsion motors, transmission (if equipped), destination signs, seating and air conditioning. Limited numbers of high circuits or special circuits may be controlled directly but these shall be subject to approval by MTS. This system design should significantly reduce electrical components such as wiring, circuit breakers, relays, rectifiers and terminal blocks.

All electrical parts shall be accessible from the interior of the bus only and shall be protected to avoid splash from floor washing, etc.

Troubleshooting shall be accomplished by use of input/output lights permanently mounted at the PLC components. Examination of the ladder logic shall be done with a standard IBM compatible laptop computer and shall be password protected to prevent unauthorized tampering. To prevent unauthorized modifications to the system, the use of electrically programmable EPROM's shall not be allowed. Forcing of electronic functions shall be possible but the bus shall not be shifted out of neutral if force is enabled or on.

PLC support shall be available within a fifty (50) mile radius of the Procuring Agency providing exchange parts, new parts and technical support.

Necessary software and interface connection shall be provided for onboard trouble shooting. Two (2) sets shall be required for this order.

The type of Logic Controller, devices and system shall be submitted for approval prior to submission of bid.

#### **5.111 WIRING**

All general purpose wiring to be cross linked polyethylene insulated, color coded over its entire length, numbered for positive identification and meet the SAE Recommended Practice #J1128, Type SXL. Grommets or other approved material shall be provided where wiring penetrates a metal structure.

Engine compartment wiring shall be stranded copper wire hi-temperature insulation covered with single layer cross-linked polyethylene insulation (SCL), and shall be contained within high-temp corrugated plastic looms.

All electrical/electronic hardware and its mounting shall comply with the shock and vibration requirements of SAE J1455.

#### **5.112 BATTERY CABLES**

Battery cables shall be a minimum of 4/0 A.W.G. and meet SAE Recommended Practice J1127, Type SGR. Cable terminals at batteries shall be  $\frac{3}{8}$ " &  $\frac{3}{8}$ ". Battery cables shall be supported in a way that does not allow cables to rest on tops of batteries while in the stowed position.

#### **5.113 JUNCTION PANELS**

The main wiring harness(es) shall be installed in sections terminating at appropriate junction panels. Junction panels are to be constructed of Bakelite type material, terminal posts to be numbered and easily accessible from the interior or exterior of the bus. A minimum twenty (10%) percent of spare wires shall be provided per harness. All main wiring harness(es) shall be insulated and concealed within the body structure.

#### **5.114 TERMINALS**

All terminals shall be of the closed barrel type, insulated and crimped to the manufacturer's specifications. In addition, all power cable terminals shall be soldered. The use of "T-TAP" connectors is unacceptable.

#### **5.115 CIRCUIT BREAKERS**

Manually resettable circuit breakers shall be provided. The use of in-line fuses shall be kept to a minimum. A circuit protector, fusible link or other suitable device shall be installed to protect 4/0 cable from a short to ground between batteries, starter, and alternator.

**5.116 ELECTRICAL PANELS**

Two (2) main electrical panels shall be provided and conform to the following:

- A wiring diagram shall be located on the doors of each electrical panel.

**5.117 MAIN ELECTRICAL PANEL**

The main electrical panels shall be located near the operator's compartment and the rear interior of the bus and shall be accessible from either the interior or exterior of bus. The panels shall be constructed to allow easy access and be as water and dust proof as possible.

A power inverter shall be installed in each vehicle which is capable of supplying a 110 VAC 60 Hz circuit protected power supply at 20 amps. The 110 VAC outlet shall be located within the side console and shall be energized anytime ignition is in the on position, whether the hybrid engine is running or not.

**5.118 REAR ENGINE CONTROL PANEL**

A rear run control panel shall be provided in the hybrid engine compartment and shall be constructed to be as water and dust proof as possible. In addition, the following shall be provided:

- Rear start switch labeled - "Start," "Front - Off - Rear."
- Hybrid engine compartment light switch labeled - "Lights," "On – Off."
- Hybrid engine run switch labeled - "Run," "Front - Off – Rear."

Hybrid engine compartment gauges: A hybrid engine oil pressure and hybrid engine water temperature gauge shall be mounted in the hybrid engine compartment so that they are easily viewed when the rear compartment door is open. The oil pressure gauge shall indicate oil pressure at a main pressure oil galley. The water temperature shall indicate engine block water temperature on the engine side of the thermostats. Gauges shall be of the mechanical type with minimum two (2") inch face and shall not utilize sending units. Oil pressure gauge shall be clearly marked in 5 psi increments. Water temperature gauge shall utilize a tell-tale indicator. Rear switches and gauges shall be mounted in an enclosed water proof/dust proof box. Location of all gauges shall be approved by MTS. The hybrid engine compartment lights shall be capable of being turned on/off regardless of the front master switch position.

**5.119 CAPACITY**

All switches, relays, circuit breakers or other load carrying devices shall be of sufficient capacity to carry the required current load imposed with an ample margin of safety, and shall be labeled and located within electrical panels.

## **INTERIOR AND EXTERIOR LIGHTING**

### **5.120 GENERAL EXTERIOR LIGHTING**

Exterior lighting and reflectors shall meet all applicable state and federal requirements. (stick-on reflectors are not acceptable). All lamps shall be replaceable in five (5) minutes or less and shall be equipped with water tight sealed connectors.

### **5.121 HEADLAMPS**

Two (2) dual head lamps shall be provided. Head lamps are to be activated from the Master Control Switch and a sealed foot operated switch shall be provided to control high and low beam operation. A high beam indicator shall be provided on the operator's dash panel.

### **5.122 STOP/TAIL/TURN LAMPS**

Tail lamps shall be mounted on the engine closure door or rear end panels so as not to be affected by hybrid engine exhaust heat. Each side shall include two (2) combination red stop/tail light assemblies, an amber turn signal assembly and a white back-up light assembly in a red, red, amber, white configuration from top to bottom. A third centered pair of high mounted stop lights shall be provided and installed. All rear directional, stop/tail, and back-up lights shall be flush mounted four (4") inch diameter Dialight LED lamp assemblies, or approved equal.

Lamp lens shall not protrude from body more than one-half (½") inch. Final layout is subject to review and approval by MTS.

Side amber turn signals with guards, two (2) per side Dialight LED, or approved equal, shall be provided. Lamps shall be forward of all wheelhouses except curbside front, which shall be aft.

All lamps shall be L.E.D. type light.

If stop and tail lamps will not be visible from the rear when the rear engine door is in it's up position, two (2) stop, turn, tail and hazard lights, Dialight model 46121RB, or approved equal, shall be installed, one (1) on each side of engine compartment.

Heavy-duty, sealed type, foot operated turn signal switches shall be furnished. They shall be mounted on a pedestal and angled toward the operator in a configuration approved by the MTS.

No audible reminder shall be provided to alert the driver that the flasher is activated.

### **5.123 BACK-UP LIGHTS AND ALARM**

Two (2) back-up lights, Dialight model 46121CB, or approved equal, one mounted on each side of engine closure door or rear end panels shall be provided. One (1) intermittent audible alarm (ECCOSA950), or approved equal, shall be provided at the rear of the bus.

#### 5.124 CURB LIGHTS

The vehicle doorways, including doorways with lifts, shall have outside raised Luminator LED lights, or approved equal, which when the door is open, provide at least one (1') foot-candle of illumination on the street surface for a distance of three (3') feet perpendicular to all points on the bottom stepread outer edge. Such light(s) shall be located below window level and shall be shielded to protect the eyes of entering and exiting passengers from glare.

#### 5.125 INTERIOR LIGHTING

The interior lighting system shall be Transmatic L20, with Advance Design Ballasts (ADB), or approved equal, and shall conform to the following requirements:

- a. The lighting system shall run the entire length of bus, starting behind standee line to rear seat area.
- b. Each fluorescent tube shall be supplied with an individual ADB unit.
- c. The forward-most lamp, one (1) each per side, will extinguish with the front doors closed and shall be Dialight VSL-CC-48C55, or approved equal, LED Strip Lighting in lieu of fluorescent tubes. The second and third fluorescent lamps on each side shall be encased in a re-usable blue poly-carbonate sleeve.
- d. An interior light switch shall be provided to allow illumination when the "MASTER CONTROL SWITCH" is in the "OFF" position and allow the interior lights to be extinguished when the "MASTER CONTROL SWITCH" is in the "NIGHT" position.
- e. A PLC adjustable timer shall allow fifteen (15) minutes of illumination after the bus is shutdown (Master switch in Off or Park position).
- f. Light fixtures shall be constructed to allow for easy tube or ballast replacement and accommodate eleven (11") inch advertising signs.
- g. Destination sign light (if equipped) shall come on with the Master Switch.
- h. Interior lights shall extinguish when the hybrid propulsion system is placed in reverse. This will aid the operator in backing the bus.
- i. The floor surface in the aisles shall have a minimum of ten (10') foot-candles of illumination, vestibule area a minimum of four (4') foot-candles when the front door is open and a minimum of two (2') foot-candles with door closed, measured on the step tread or ramp platform.
- j. Rear exit area and doorway shall have at least four (4') foot-candles of illumination with rear doors open and at least two (2') foot-candles of illumination measured on the step tread with doors closed.
- k. Door header lights shall be Dialight 17081CB, or approved equal, two (2) per doorway.
- l. Step lighting for the intermediate platform between lower and upper floor levels shall be provided and shall illuminate in all hybrid engine run positions. All step well lights shall be low-profile LED and shall be shielded as necessary to protect passengers' eyes from glare.

- m. The front entrance area and curb lights shall illuminate with front door open and master run switch in night run or park position. Circuit shall be activated by the use of an air pressure switch and shall not incorporate the use of position sensing micro switches. The rear step well lights shall be on when the master switch is in the night run or park position. Rear exit area and curb lights shall illuminate when rear door is unlocked/open.

#### **5.126 "STOP REQUESTED" PASSENGER SIGNAL**

A "Stop Requested" passenger signal system shall be provided. A "Stop Request" indicator shall be provided on dash panel in plain view for operator visibility at all times. A ceiling mounted "Stop Requested" sign shall be installed directly above the standee line. When a passenger pulls the cord, a chime shall sound, the ceiling mounted "Stop Request" sign and dash indicator shall illuminate. The chime shall sound once and the sign and dash lights shall remain illuminated until after the front or rear doors open or a cancel switch is activated. Vertical pull cords shall be provided for the handicapped area located by the front forward facing seats. Tape switches are acceptable for handicap location under longitudinal flip-up seats. A separate dash indicator light shall be activated when a mobility aid user wishes to disembark and the chime shall sound twice. All pull-cords and tape switches shall be bright yellow in color.

#### **5.127 HORNS**

Dual electric horns with splash shields shall be provided with horns turned facing down to preclude the collection of water.

#### **5.128 DRIVER'S CONTROL AND INSTRUMENT PANEL**

The Operator's Control and Instrument Panel shall include, but not be limited to, the following requirements:

1. Four (4) position Master Control Switch OFF, Day-Run, Night-Run, Night Park.
2. Engine start button with dust cover.
3. Instrument and dash-lights (rheostat controlled).
4. Interior light switch.
5. 3-position defroster switch, Hi-Lo-Off.
6. HVAC control switch, Auto-Off-Vent.
7. Emergency parking brake release, properly marked with a metal label riveted by the park brake control valve.
8. Emergency flasher switch.
9. Test switch for dash indicator lights.
10. Dual air pressure gauge(s) with light.
11. Voltmeter (2") with light.
12. Engine temperature gauge (2") with light.
13. Electronic speedometer, with odometer and light.
14. Passenger signal On-Off switch.

15. Stop request cancel switch.
16. Wheelchair ramp control.
17. Kneel switch.
18. Fast idle switch.
19. Hybrid engine and generator test socket.
20. Bulb outage test switch for exterior lighting (i.e. Head Lamps, Marker, Clearance, Turn signals, Stop lamp, Tail lamp, Back-up lamps & Alarm).
21. Parking brake application valve, properly marked with a metal label riveted by the control valve "Pull to set, Push to release".
22. Floor mounted headlight, high/low beam foot switch.
23. Floor mounted turn signal foot switches.
24. Electronic throttle foot pedal.
25. Floor mounted P.A. microphone switch.
26. Brake pedal.
27. Hybrid propulsion system gear selector.
28. Emergency radio alarm switches (silent alarm). Allen Bradley with two sets of contacts, one normally open and one normally closed.
29. Waste basket (floor).
30. Eight (8) pocket Plexiglas Schedule Rack. (integrated into driver barrier)
31. Dash route/fare card holder.
32. Driver shall be provided with a reading lamp with toggle switch on side console.
33. Low fuel indicator light.
34. SpeakEasy II controls.

#### **5.129 OPERATOR AUDIBLE WARNING**

An audible warning and light system will be provided for the operator that conforms to the following requirements:

	<u>Indication</u>	<u>Buzzer</u>	<u>Dash Indicator</u>	
a)	Low air (below 80psi)	(Yes)	Red	(Yes)
b)	Low oil pressure	(Yes)	Red	(Yes)
c)	Engine temperature	(Yes)	Red	(Yes)
d)	Generator/transmission	(Yes)	Red	(Yes)
e)	A/C off	(No)	Red	(Yes)
f)	Directional signals	(No)	Green w/arrow	(Yes)
g)	Stop light	(No)	Red	(Yes)
h)	Next stop	(Yes)	Red	(Yes)
i)	E/H next stop	(Yes)	Red	(Yes)
j)	High beam	(No)	Blue	(Yes)
k)	No charge	(Yes)	Red	(Yes)
l)	Rear door	(No)	Red	(Yes)
m)	Kneel	(No)	Red	(Yes)

n)	<u>Indication</u> Low fuel light	<u>Buzzer</u> (Yes )	<u>Dash Indicator</u> Red	(Yes)
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A test switch shall be provided which allows all indicator lights to be tested at once. Visibility of all dash indicators shall not be obscured by steering wheel.

### 5.130 GENERATOR

A Leece-Neville model VLF3278-002, or approved equal, 28 volt belt driven, 300 ampere (maximum rated output) brushless DC generator shall be provided. The generator to be driven at 2.75 times engine speed. Solid state rectifiers shall be used to convert AC to DC. A circuit protector, fusible link or other suitable device shall be installed to protect 4/0 cable from a short to ground between batteries and alternator.

### 5.131 VOLTAGE REGULATOR

A solid state Leece-Neville voltage regulator will be installed in a location and manner to minimize adverse effects of temperature extremes. The regulator shall be an adjustable variable setting-type.

### 5.132 BATTERIES

Two (2) Ramcar C-A8D12T, or approved equal, heavy duty 8D end mount batteries with permanent factory burned bus type terminals shall be provided. A heavy duty battery disconnect switch and a battery cut-out relay shall be provided. A minimum 80amp "Vanner," or approved equal, voltage equalizer shall be installed outside the battery compartment in a location that is as dust proof and water proof as possible and easily accessible. There shall be no switches, circuit breakers or other electrical components mounted in the same compartment as the batteries. The sliding tray assembly shall be made of stainless steel with a removable fiberglass liner. Provisions shall be made so that battery cables do not rest on batteries while battery tray is in the stowed position.

### 5.133 KNEELING SYSTEM

A "kneel" system shall be provided on each bus meeting the following requirements:

- With the front doors open, hybrid propulsion system in neutral gear, bus operator will lower the curbside of the bus with activation of a dash mounted momentary "kneel" switch (Lower).
- An audible alarm shall sound, a warning light visible from the front curbside of the bus shall flash, and an operator's indicator shall light during the entire operation of "kneel" functions.
- The brake and accelerator interlocks shall activate during the entire operation of "kneel" functions.
- Normal driving conditions shall be resumed after momentary activation of "kneel" switch (raise) and bus reaches normal driving height.

- The "lower" and "raise" heights shall be preset and be achieved automatically after activation of desired functions and require a maximum of ten (:10) seconds to complete each function.
- A guarded override momentary switch shall be provided, designed so that the brake and accelerator interlocks can be de-activated by the bus operator to allow movement of the bus in case of emergency.
- An indicator visible to the operator shall be illuminated until the bus is raised to a height adequate for safe street travel.

### **ANCILLARY EQUIPMENT SPECIFICATIONS**

#### **5.134 BIKE RACKS**

Contractor shall provide a two (2) position bicycle rack as manufactured by Byk-Rak, or approved equal, stainless steel front mounted transit bike rack with heavy-duty quick disconnect type mounting bracket which is integral with front bumper. Contractor and MTS to mutually agree on location and mounting. (Positioning is not to interfere with the front license plate).

#### **5.135 PUBLIC ADDRESS SYSTEM**

A Public Address System shall be provided on each bus meeting the following requirements:

- a) One (1) amplifier, microphone, control unit combination - Clever Devices, SpeakEasy II, or approved equal.
- b) Six (6) speakers-10 watt, 8 ohm rating.
- c) Speakeasy II unit shall be located at the roadside "A" post. Control shall be provided by a foot control switch mounted on the floor. Mounting location and arrangement of the microphone and floor switch shall be approved by MTS.
- d) One (1) external speaker-REI, or approved equal, to be mounted above front door area shall be provided.
- e) Interior/Exterior speaker selection switch shall be mounted on instrument panel. Switch shall be a three (3) position toggle switch to provide interior/exterior/both operation of the speakers. Location shall be approved by MTS.
- f) Power switch shall be mounted on instrument panel. Switch shall be a two (2) position toggle switch to provide on-off operation of the amplifier. Location shall be approved by MTS.
- g) One (1) auxiliary microphone jack shall be provided on rear side of the operator's barrier. Also, one (1) auxiliary microphone, Shure #507B, or approved equal, with extension cord shall be provided at the rate of one (1) for every ten (10) buses.

### 5.136 DESTINATION SIGN

A Luminator® Horizon all LED Destination Display System, or approved equal, shall be furnished and installed in the bus. The sign system shall consist of:

#### DISPLAY SIGNS:

- Front Sign: 24 x 200 Titan GEN 4 (**amber**)
- Side Sign: 14 x 112 (**amber**)
- Rear Sign: 16 x 48 (**amber**)
- Operator Display and Keyboard: (ODK)
- Cables and Accessories

The Front Sign shall be mounted on the front of the bus, near the top edge of the body, behind windshield protection, and in an enclosed but accessible compartment. The destination sign glass, if larger than actual sign, shall be blacked-out around edges eliminating the need for shrouding around sign and thus blocking unsightly wiring within the destination sign compartment from exterior view. Only amber colored LED's shall be used in the front sign.

The Side Sign shall be located on the right side of the bus near the front door either mounted near the top of an existing window or in a separate enclosed but accessible weather-proof compartment.

The Rear Sign shall be mounted on the rear of the bus near the right side of the upper roof line or rear center of the vehicle.

The entire display area of all signs shall utilize high-intensity LED displays that provide clear readability in direct sunlight, at night, and in all lighting conditions between those two lighting extremes, with evenly distributed illumination appearance to the un-aided eye.

The system shall be microprocessor-based utilizing approved bi-directional serial communications between system component compatible with SAE J-1708, RS232 and RS485 protocols.

The system shall be capable of communicating with, and/or controlling additional information devices, such as interior information signs, voice annunciation devices, farebox, etc. The system shall provide for destination and/or public relations (P/R) message entry.

Message memory shall be changeable by the use of a MTU and/or PCMCIA card of not less than one (1) megabyte memory capacity but sized according to the message listing noted herein.

The System shall have the ability to sequentially display multi-line destination messages with the route number portion remaining in a constant "on" mode at all times, if so programmed.

The various signs shall be programmable to display independent messages or the same messages; up to two (2) destination messages and one public relations message shall be pre-selectable. The operator shall be able to quickly change between the pre-selected messages without re-entering a message code. Public relations messages shall be capable of being displayed alternately with the regular text and route messages or displayed separately.

System shall be capable of displaying an emergency message when activated by a push button or toggle switch in a location to be approved by MTS. The emergency message shall be displayed on signs facing outside the vehicle while signs inside the vehicle, including the ODK display, remain unchanged. The emergency message shall be canceled by entering a new destination code, or power cycling (after removal of the emergency signal).

The programming software shall provide means of adjusting the length of time messages that are displayed in one (:01) second increments for up to twenty-five (:25) seconds.

Power to the sign system shall be controlled by the bus Master Run Switch. The signs shall operate in all positions of this switch except "Off." The signs shall be internally protected against voltage transients and RFI interference to ensure proper operation in the local environment.

The characters formed by the system shall meet the requirements of the Americans with Disabilities Act (ADA) of 1990 Reference 49 C.F.R. Section 38.39.

#### **SIGN ENCLOSURES:**

All signs shall be enclosed in such a manner to inhibit entry of dirt, dust, water and other contaminants during normal operation or cleaning. Access shall be provided to clean the inside of the bus window(s) associated with the sign and to remove or replace the sign components. Access panels and display boards shall be mounted for ease of maintenance/replacement. Any exterior rear sign enclosure used shall be made of polycarbonate material containing fiberglass reinforcement. The vehicle manufacturer shall comply with the sign manufacturer's recommended mounting, mounting configuration, and installation procedures to assure optimum visibility and service accessibility of the sign system and system components.

#### **ELECTRONIC SYSTEM REQUIREMENTS:**

All electronic circuit boards used in the sign system shall be conformal coated to meet the requirements of military specification MIL-I-46058C. All sign system components shall be certified to have been subjected to a "burn-in" test of a minimum of twelve (12) hours operation in a temperature of one hundred fifty (150°) degrees F prior to final inspection.

#### **FRONT SIGN:**

The front sign message shall be readable by a person with 20/20 vision from a distance not less than three hundred fifty (350') feet for signs of display height greater than eight (8") inches and from a distance not less than two hundred seventy-five (275') feet for display heights less than eight (8") inches. The front sign shall have a viewing cone of

equal readability at sixty-five (65°) degrees on either side of a line perpendicular to the center of the mean plane of the display. The intensity of the illumination of the display LED's shall appear, to the naked eye, to be approximately uniform throughout the full viewing cone.

**SIDE SIGN:**

The Side Sign message shall be readable by a person with 20/20 vision, from a distance of not less than two hundred seventy-five (275') feet. The side sign shall have a viewing cone of equal readability at sixty-five (65°) degrees on either side of a line perpendicular to the center of the mean plane of the display. The intensity of the illumination of the display LED's shall appear, to the naked eye, to be approximately uniform throughout the full viewing cone.

**REAR DESTINATION SIGN:**

The Rear Sign shall be capable of independently displaying alpha-numeric characters. It's message shall be readable by a person with 20/20 vision, from a distance of not less than two hundred twenty-five (225') feet. The rear sign shall have a viewing cone of equal readability at sixty-five (65°) degrees on either side of a line perpendicular to the center of the mean plane of the display. The intensity of the illumination of the display LED's shall appear, to the naked eye, to be approximately uniform throughout the full viewing cone.

**OPERATOR DISPLAY AND KEYBOARD (ODK):**

The ODK unit shall be used to view and update display messages. ODK shall be recess mounted on the bus vehicle front sign compartment access cover or door. The ODK shall utilize a multi-key conductive rubber pad keyboard and be designed for transit operating conditions.

The ODK unit shall contain a display of at least two-lines of 20-character capability. The ODK unit shall contain an audio enunciator that beeps to alert the operator to view the display for a message, or beeps indicating that a key is depressed. The ODK unit shall continuously display the message associated with the selected destination readings (except the emergency message feature as noted above).

**PROGRAMMING:**

A Windows® based programming software package shall be supplied including laptop, under limited-use license, to generate message lists for the sign system.

The program shall be designed for ease of deleting and adding messages to a destination sign list in a Windows® Operating Environment.

The programming software shall be intuitive, of design to facilitate ease of training, and use context-sensitive help features. On-site training support shall be provided with the software.

This software shall provide capability for custom message writing by selection of preprogrammed standard variable width fonts; by creation of a custom font; by varying spacing between characters, words, or other message elements; by allowing creation of graphic displays, with or without text; by selecting preprogrammed graphic sign images; and by allowing use of multiple fonts within the same message and graphic symbols placed anywhere within the display area.

#### **MESSAGE MEMORY TRANSFER AND UPDATE:**

The sign system shall be re-programmable on the bus vehicle with the use of a Personal Computer Memory Card International Association (PCMCIA) card and/or Memory Transfer Unit (MTU). A PCMCIA card slot shall be provided on the ODK face for this purpose. The maximum reprogramming time for a 10,000 line listing shall be one minute. PCMCIA cards, of appropriate memory capacity based on requirements of the message listing noted below (but not less than 1 Megabyte) shall be supplied at the rate of two cards for this procurement. MTU connection shall be accessible from the outside of the front destination sign access door via a connector located on the access door.

#### **MESSAGE LISTING:**

Upon receipt of the contract/purchase order the Contractor shall supply to the sign manufacturer, within fourteen (14) days, a list of the message readings or listings such as to allow the Sign System to be preprogrammed with the correct readings for MTS revenue service operations.

#### **5.137 FAREBOX SYSTEM**

A forty-one (41") inch GFI Odyssey farebox with Cubic DCU, or approved equal, shall be supplied and installed. A farebox ground strap to bus chassis shall be provided. Fareboxes shall be mounted directly to the floor of the vehicle rather than on a raised pedestal. Mounting shall be reinforced to limit movement of farebox, i.e., vibration, shaking, etc. A raised step assembly shall be constructed to fit around base of the farebox with a rubber shroud assembly designed and installed to fill the gap between step and farebox. Photos of an MTS installation shall be provided to assist in the design of the step assembly.

#### **5.138 RADIOS**

A Motorola/Orbital radio/CAD/AVL communication system shall be installed to include radio antenna, GPS receiver, and LAN antenna. Such a system shall include Automatic Passenger Counter (APC). Contractor shall install the radio system as currently installed on MTS fleet. A conditioned 12 volt/30 Amp power supply and chassis ground shall be provided in radio equipment box. Mechanical alarm interface shall also be provided and installed by manufacturer during vehicle assembly. Mechanical alarm interface connector shall terminate at a DB25 connector in radio equipment box. An Allen Bradley silent alarm switch shall also be provided and installed. Details of radio provisions shall be provided at the pre-production meeting.

**5.139 AUTOMATIC PASSENGER COUNTER (APC):**

Each vehicle shall be equipped with on-board APC equipment which shall be interfaced with the Motorola/Orbital RTMS Radio/CAD/AVL system as currently utilized on MTS buses. The APC equipment shall include all sensors, wiring, cabling, and installation required to enable interfacing with the RTMS system to allow the passenger count to be correctly associated with the GPS-based location, block, bus stops, and date and time. The sensors to detect passenger boarding and de-boarding shall not use step-treadle technology, but shall use infrared or other similar sensors that have a high level of reliability and are easily serviced. The sensors shall have a demonstrated accuracy of ninety-five (95%) percent or better.

Collected data shall be processed prior to permanent storage in order to ensure that the collected data is at least ninety-five (95%) percent accurate and that it is statistically valid. This processing shall include removal of clearly erroneous data, such as may occur from sensor failures. Processing shall also remove data for buses that would otherwise improperly affect statistical results for monitored bus routes due to temporary and unanticipated changes to the operation of buses on those routes. Changes of this type to be detected shall include, but not be limited to, significant off-route operation, significant off-schedule operation, breakdowns, and unscheduled turn-backs. Parameters for determining various filtering thresholds required by the processing shall be definable by system management users.

**5.140 WHEELCHAIR RAMP**

A Ricon Corporation Foldover Model FR3048, or approved equal, low floor automatically-controlled, power operated wheelchair ramp system shall be provided. The ramp shall be designed for use to provide ingress and egress quickly, safely and comfortably, both in forward and rearward directions, for a passenger in a wheelchair from a level street, curb, or raised platform stops. The wheelchair ramp shall be able to be manually deployed in thirty (:30) seconds or less in the event the hydraulic drive system should fail. Ramp shall be compliant to requirements defined in 49 C.F.R. Part 38, Subpart B 38.23c.

The wheelchair loading system shall be located at the front door. The ramp shall be of a simple fold over type design, rotary actuated and hydraulically-powered. The wheelchair ramp assembly shall be mounted to the bus structure separate from the front bumper to eliminate damage to the ramp assembly when the bumper may sustain minor damages in a low speed collision. The ramp shall be fully self-contained and shall not be operated from an external pump, actuator or cam mechanism.

When the system is not in use, the passageway shall appear normal. In the stored position of the ramp, no tripping hazards shall be present and any resulting gaps shall be minimized. The controls shall be simple to operate with no complex phasing operations required and the loading system shall be under surveillance by and complete control of the operator. The bus shall be prevented from moving during the loading or unloading cycle by a throttle and brake interlock system. The wheelchair loading system shall not present a hazard, nor inconvenience any passenger. The loading system shall be inhibited from retracting or folding when a passenger is on the ramp/platform. A passenger departing or boarding via the ramp shall be able to easily obtain support by grasping the passenger assist located on the doors or other assists provided for this

purpose. The platform shall be designed to protect the ramp from damage and persons on the sidewalk from injury during the extension/retraction or lowering/raising phases of operation. The loading platform shall be covered with replaceable or renewable, nonskid material and shall be fitted with devices to prevent the wheelchair from rolling off the sides during loading or unloading. Deployment or storage of the ramp shall require no more than fifteen (:15) seconds. The device shall function without failure or adjustment for 500 cycles or 5,000 miles in all weather conditions on the design operating profile when activated once during the idle phase. A manual override system shall permit unloading a wheelchair and storing the device in the event of a primary power failure. The ramp assembly shall be replaceable within thirty (30) minutes by a 3M mechanic.

#### **5.141 WHEELCHAIR RESTRAINT**

The wheelchair restraint system shall be ADA approved and accommodate a range of wheelchairs commonly available to handicapped persons and shall not require any manual adjustments to meet this requirement. The restraint system shall be an Advanced Restraint Module (the A.R.M. telescoping arm model) from American Seating, or approved equal. The automatic locking mechanism of the restraint shall not be capable of being engaged unless the wheelchair is properly aligned in the restraint. The locking mechanism of restraint when being engaged or disengaged shall not be capable of harming the disabled person. When secured by the restraint, the wheelchair shall be prevented from side slipping, pivotal rotation, forward and backward motion, and overturning due to the motion and maneuvering of the bus. The restraint system shall be designed and manufactured so as to minimize pilferage and/or vandalism. The restraint system for wheelchairs shall be manufactured by American Seating Q-Straint, or approved equal. Wheelchair restraint shall be constructed from aluminum and/or rust-resistant steel.

The wheelchair restraint system shall be warranted against operational problems resulting from manufacturing and/or design defects. Each restraint unit shall be serialized for warranty tracking purpose.

#### **5.142 DIGITAL RECORDING EQUIPMENT (Security Cameras)**

Buses shall be equipped with an On Board Video Surveillance System (OBVSS). The system shall be a digital system that records to a removable hard drive. Each system shall be comprised of seven (7) color cameras, a digital video recorder, and all necessary cable and hardware to permanently secure all the components. The OBVSS shall have a warranty (non-prorated) on the entire system for a period of not less than 1 year. All systems must be "state of the art" new equipment. The recording equipment shall be durable and designed specifically for transit bus installation. Video shall be recorded to an adequately sized removable hard drive unit(s). The removable unit shall be of modular design with no access to the recording media or internal components and shall be tamper proof. The removable cartridge shall be securely retained in the recording device and shall be locked in place by means of tamper proof lock and key arrangement. Recording unit shall also be enclosed inside of a locked box type container, and securely mounted. All recording unit cartridges and locks shall be interchangeable and "keyed alike" To match current keys in use at MTS. An operator's status indicator light, which shows whether system is functional or not, shall be installed in each vehicle. The status indicator shall be red for any malfunction or green indicating all system functions are operating properly. The system shall include an event-marking feature readily available to the operator, as well as an event marking feature integrated

with the vehicle's silent alarm function (Note: the normally open contacts on silent alarm switch are available for this feature). An X, Y, & Z axis impact sensor shall also be utilized as an event marking trigger. All recorded data shall be identified with visible on frame information including, but not limited to, date, time, location and bus number. Continuous loop, uninterrupted recording time shall be not less than three hundred thirty-six (336) hours – fourteen (14) days before recording is overwritten. Such recording time shall be minimum 640 x 240 resolution at a minimum 15 fps/camera and shall have the ability to be upgraded to up to ninety (90) days of storage. The system shall be capable of wireless downloading of video and shall have the ability to be viewed in real-time from a remote location up to two hundred (200) yards away.

#### **5.143 CAMERAS**

Each bus shall be fitted with a seven (7) color camera system capable of monitoring the entire interior of the bus, exterior front view, exterior rear view, and exterior curbside view. Interior areas of special consideration are the front and rear door and step areas, and the area rear of the rear door. Cameras shall be adjustable on both vertical and horizontal planes, designed to operate in both normal daylight and nighttime lighting conditions, and protected by a tamper proof enclosure. Property shall provide a basic diagram for camera location and direction of view.

#### **5.144 MICROPHONE**

Audio shall be required for operator's entrance area. Microphone shall be connected to camera that has view of driver, farebox, and entrance door.

The quality of the audio shall be such that a normal voice conversation between the operator and a passenger in the front entrance area of the bus can be understood with all accessories operating.

#### **5.145 SIGNAGE**

Four (4) signs shall be provided and installed on the inside of each bus, two (2) in English and two (2) in Spanish that read:

**"NOTICE: THIS VEHICLE IS EQUIPPED WITH A DIGITAL SURVEILLANCE SYSTEM. PASSENGER ACTIVITY MAY BE RECORDED BUT NOT MONITORED"**

-And-

**"AVISO: ESTE VEHICULO ESTA EQUIPADO CON UN SISTEMA DE VIGILANCIA DIGITAL. LAS ACTIVIDADES DE LOS PASAJEROS PODRIAN SER GRABADAS, PERO NO MONITOREADAS"**

One (1) of each of the signs (one English and one Spanish) shall be placed in a conspicuous location in the front portion of the bus, and one (1) of each in a conspicuous location in the rear portion of the bus. The signs shall be approximately four (4") inches high by six (6") inches wide with a glossy finish.

**5.146 TRAINING/MANUALS/DOCUMENTATION**

Technical and maintenance training twenty-four (24) hours shall be provided for all supervising staff and mechanical staff. Maintenance training shall include basic routine maintenance checks and troubleshooting to include camera adjustment, software reconfiguration, recorder replacement, and replacement of any internal batteries if equipped. Manuals as listed below shall be provided in the following quantities:

- Four (4) operation instruction manuals
- Four (4) parts & service manuals
- Four (4) software manuals

The Contractor shall be one hundred (100%) percent responsible for technical support for the entire system.

**5.147 PLAYBACK STATIONS**

Two (2) separate stations and software shall be provided. At least one (1) of the playback stations shall be of mobile type (i.e., laptop).

A specific product shall be proposed, including complete specifications, as well as all other options available.

**5.148 SPARES**

The Contractor shall supply one (1) complete spare system and four (4) spare removable hard drives, and four (4) spare cameras.

**5.149 SERVICE**

The Contractor shall identify the local service provider who will address warranty, post-warranty service and technical support. The qualifications of that local service provider shall be included as part of the proposal.

**5.150 HEATING AND AIR-CONDITIONING (HVAC)**

A combined heating and air conditioning Thermo King, or approved equal, All-Electric T-Series one-piece self-contained rear mount unit shall be provided. The all-electric unit shall be charged, sealed and tested at the Thermo King factory and shipped ready for connection to specified power requirements. The scroll compressors, evaporator and condenser motors shall operate on 230VAC 3-phase 60hz power. The IntelligAire II microprocessor shall operate on 27VDC power. The microprocessor shall control and monitor all unit modes and functions, including safety shutdown protection. The two scroll compressors shall have the ability to operate simultaneously or independently as power demands and cooling requirements vary. The air conditioning/heating system shall be a self-contained unit mounted in rear of bus. Materials and mounting shall be of sufficient quality and construction to withstand road shock and vibration.

**UNIT OPERATION:**

- AUTO, COOL, HEAT, VENT modes shall be selected through driver's display panel.
- The dual scroll compressors shall be thermostatically controlled for 2-stage capacity control in the cool and/or auto mode.
- The 2-speed evaporator and condenser motors shall be thermostatically controlled based on operating conditions.

The system shall meet the following minimum requirements:

**A) MINIMUM CAPACITY**

1. Main heating system-90,000 BTU's/HR and 1,550 CFM of air flow (Low Speed).
2. Air Conditioning shall utilize R-407C Refrigerant – minimum cooling capacity of 81,000 BTU/HR and 2,250 CFM of air flow (High Speed).

**B) COMPONENTS**

1. Condenser motors shall be 230VAC/3PH/60HZ minimum 1.0 horsepower.
2. Evaporator motor shall be 230VAC/3PH/60HZ minimum 1.7 horsepower.
3. Compressors – Scroll 230VAC/3PH/60HZ.
4. Condenser Core-Copper tubing with aluminum fins.
5. Evaporator Core-Copper tubing with aluminum fins.
6. Refrigerant - R-407C.
7. IntelligAire II microprocessor control system.
8. IntelligAire II Smart-Pac diagnostics.
9. Standard operator display/control panel for IntelligAire II.
10. Heater boost pump with minimum capacity of 15 G.P.M. shall be an EG&G Rotron brushless seal-less magnetic drive, or approved equal.

**5.151 HVAC SYSTEM OPTION WITH STANDARD CNG PROPULSION SYSTEM**

A combined heating and air-conditioning system, Carrier, or approved equal, RM Series with the 05G compressor and clutch assembly shall be provided on each bus. System shall include MicroMax microprocessor for climate controls and Micromate Control Panel high visibility display. The bus heating and ventilating systems shall be designed to provide passenger comfort by heating or cooling, dehumidifying and filtering the air which is force circulated within the bus. The system shall be designed to maintain bus interior temperature to a minimum of sixty-five (65°) degrees F with a relative humidity of fifty (50%) percent or less at all locations in the bus under all operating conditions during all climatic conditions. This system shall meet the following minimum requirements:

**A. CAPACITY**

1. Main heating system-90,000 to 100,000 BTU's/HR and 1,300 CFM's of air (Low Speed).
2. Driver's Heating System-40,000 BTU's/HR and 500 to 600 CFM's of air.

3. Air Conditioning-120,000 BTU/HR and 2,800 CFM of air or nominal 10 tons.

**B. COMPONENTS**

1. Condenser Motors-General Electrical brushless field wound motors/or equivalent.
2. Evaporator Motor-General Electric Brushless motor/or equivalent.
3. Compressor- Carrier O5G belt driven with electro magnetic clutch.
4. Condenser Radiator-Copper tubing with aluminum fins.
5. Evaporator Radiator-Copper tubing with aluminum fins.
6. Expansion Valve-External equalization type.
7. Refrigerant-R134a.
8. Micromate Control Panel (MCP) high-visibility display.
9. Return air thermostat-Electronic, adjustable from sixty (60°) degrees to ninety (90°) degrees F (return air temperature).
10. Heater Boost Pump-Minimum capacity of 15 G.P.M. to be an EG&G Rotron brushless seal-less magnetic drive, or approved equal.

**C. CONSTRUCTION AND MOUNTING**

1. The air conditioning/heating system shall be an integrated unit mounted in the rear of bus. Materials and mounting shall be of sufficient quality and construction to withstand road shock and vibration.
2. Push pull cable shall not exceed twenty-four (24") inches in length or mounted as close as possible to any water valves or baffles.

**D. SAFETY CONTROLS**

1. Resetable circuit breakers on all electrical motors and power cables.
2. Low Freon pressure cut-out.
3. High Freon pressure cut-out.
4. Low compressor oil pump pressure.
5. Power relay to disable HVAC unit if bus charging system fails.

**5.152 OPERATOR'S HEATER AND DEFROSTER**

- A. The operator's heater and defroster system shall be independently controlled with easily moveable cable or electronic control.
- B. The defroster shall meet all State and Federal requirements.
- C. The system shall be located under the dash to provide heat or fresh air for the operator.
- D. The system shall also heat the front step well and operator's foot area.
- E. This system shall be equipped with an auxiliary water pump capable of pumping fifteen (15) gallons of water per minute, so as to force hot water to the heater/defroster core. Such a pump shall be located in an easily accessible area and away from road debris and inclement weather. This system shall also provide shut-off/isolation valves and manual bleed valves at the pump and core.
- F. Such a system shall be able to entirely clear the windshields, operator side window and front door glass regardless of weather conditions.
- G. The defrost motor shall provide no less than three (3) blower speeds.

**5.153 PIPES AND HOSES**

All heater and water lines shall be of heavy-duty copper or brass except where shock absorbing or flex-type lines are required. All joints shall be of the slip-fit soldered type. All lines not enclosed within the body or passenger areas shall be heavily insulated.

**5.154 HEATER CORES**

All heater cores shall be constructed of copper and brass.

Metal used in the tanks shall be of adequate thickness with drawn reinforcements. All tanks shall be of sufficient size to preclude fatigue failure.

Heater cores, motors and fans must be readily accessible and installed to permit easy removal.

**SAFETY REQUIREMENTS****5.155 GENERAL SAFETY REQUIREMENTS**

All structural and load bearing members of the restraint systems shall be made of aluminum and/or rust-resistant steel. The wheelchair restraint system shall restrain the wheelchair in a forward facing direction in the bus. All retention components which attach the restraint to the bus, as well as all parts of the restraint, shall be capable of withstanding any load developed by a one thousand (1,000) pound horizontal deceleration force as might be created by the combined weight of restraint and wheelchair in an emergency situation. The wheelchair restraint system shall be of proven quality and shall function without failure or re-adjustment for 500 cycles. (Restraining a wheelchair and releasing restraints defined as one cycle). This is the case for all operating conditions. Any switches, sensing devices and/or electrical components shall be sealed to prevent contamination by water, humidity, dust or dirt. Also they shall be of proven quality and shall not require adjustment or replacement under normal usage.

**5.156 REAR WHEEL OBJECT DEFLECTOR**

Each bus shall be equipped with a heavy duty DANGER ZONE OBJECT DEFLECTOR to be installed on the curbside forward of the bus rear wheels. The danger zone object deflector shall be the S-1 Gard, as manufactured and distributed by the Public Transportation Safety Corp., or approved equal, and is intended to deflect or push objects away from the track of the curbside rear wheels. The deflector's physical configuration and installation on the bus shall be such that objects or passengers that fall while exiting from the bus rear door, or persons that trip and fall in the path of the right rear wheels are pushed aside and away from the rear wheel track.

The deflector shall be constructed of the highest quality material capable of resisting material degradation due to common chemical and environmental debris. Workmanship shall be professional. All screws, bolts, nuts, washers and other fasteners used in the deflector installation shall be zinc or cadmium plated to prevent corrosion. Bolts and nuts shall be a minimum of SAE Grade 8. flat and lock washers shall be used when fastening component assemblies together or attaching same to the under structure. The deflector structural mounting brackets installation/attachment shall not have a negative effect on

the strength and structural integrity of the bus under structure. The deflector shall be installed so that the outside vertical surface of the polyurethane boot and guard protector does not extend beyond the side of the tire that would create snagging or premature curb-induced wear.

The mounting location of the deflector for each bus shall be such that it would clear and prevent deflector damage when buses are lifted with any one of the following four types of bus hoists:

- Portable type wheel contact/engagement bus hoist.
- In ground axle engagement bus hoist.
- In ground platform drive-on bus hoist.
- Above ground parallelogram drive-on bus hoist.

Both the deflector boot and guard protector assembly shall be black in color.

#### **5.157 SAFETY TRIANGLE REFLECTOR KIT & FIRE EXTINGUISHER**

A set of three (3) safety reflecting triangles (Reflector Kit) shall be provided. Storage location of Reflector Kit shall be in a dedicated compartment within the operator's barrier assembly.

A fire extinguisher (5 pound rechargeable 1-A:10-BC rated) shall be provided and mounted on the top of the curbside front wheelhousing in every bus.

### **SPARE PARTS, TOOLS, AND MANUALS**

#### **5.158 SPARE ENGINE**

One (1) complete B5.9 Liter CNG engine power module excluding hybrid generator.

#### **5.159 BRAKE AND SUSPENSION TOOLS, ETC.**

One (1) complete set of MAN axle and brake system tools.

One (1) King Pin Press.

#### **5.160 PORTABLE COMPUTER**

Two (2) laptop computer, Panasonic Toughbook CF-51, or approved equal, suitable for diagnosing and troubleshooting the various onboard systems

### **SYSTEM TROUBLESHOOTING TOOLS, MANUALS & SOFTWARE**

#### **5.161 ELECTRICAL/PLC SYSTEM**

Provide one (1) set of Programming and Troubleshooting Software for PLC System to include interfacing cables and any subscription fees for first year. Also provide one (1) set of manufacturer's troubleshooting manuals.

**5.162 HVAC SYSTEM**

Provide one (1) HVAC system diagnostic tool including interfacing cables. Also provide two (2) sets of manufacturer's parts and service manuals.

**5.163 HYBRID ENGINE**

Provide one (1) set of diagnostic and troubleshooting software subscriptions to include interfacing cables and adapters (i.e., 9-pin Deutsch connectors and Inline "4" Adapters). Also provide two (2) sets of manufacturer's parts, service and troubleshooting manuals.

**5.164 HYBRID GENERATOR**

Provide one (1) set of diagnostic and troubleshooting tools, interfacing cables and software Provide two (2) sets of manufacturer's parts, service and troubleshooting manuals.

**5.165 PROPULSION MOTORS**

Provide one (1) set of diagnostic and troubleshooting tools, interfacing cables and software Provide two (2) sets of manufacturer's parts, service and troubleshooting manuals.

**5.166 TRANSMISSION (IF SO EQUIPPED)**

Provide one (1) ZF Transmission diagnostic and troubleshooting kit (Testman Pro kit). Kit includes software, interfacing cables, and interfacing adapters. Also provide two (2) sets of manufacturer's parts, service and troubleshooting manuals.

**5.167 ANTILOCK BRAKE SYSTEM (ABS)**

Provide one (1) set of ABS System diagnostic and troubleshooting software, or PCMCIA diagnostic and troubleshooting card for Pro-link® if PC software is not available. Also provide two (2) sets of manufacturer's troubleshooting manuals.

**MANUFACTURER'S SERVICE, PARTS, & OPERATOR'S MANUALS****5.168 OPERATOR'S MANUALS**

Provide twenty (20) bus operator's manuals.

**5.169 MANUFACTURER'S SERVICE MANUALS**

Provide four (4) bus service manuals.

**5.170 MANUFACTURER'S PARTS MANUALS**

Provide four (4) bus parts manuals.

**5.171 MANUFACTURER'S ELECTRONIC FORMAT MANUALS**

Provide one (1) Electronic Format (CD-ROM) bus manual, which include drawings, schematics, OEM manuals for major components such as hybrid engine, transmission (if so equipped), HVAC, PLC system, destination signs, etc.

<b>SECTION 6</b>
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**40' LOW FLOOR CNG TRANSIT BUS TECHNICAL SPECIFICATION****6.0 GENERAL**

The following technical specifications represent MTS's minimum core requirements for 40' transit buses. Buses submitted for acceptance shall conform to the following core requirements. Deviations from this specification or substitutions from specified materials, parts and equipment shall not be undertaken without prior written approval from the MTS. (See Section 1.4 and 1.5 "Proposers Communications and Requests" and "MTS Responses to Communications and Requests" for details on this process). Any exceptions, conditions, reservations, understandings or deviations must be explicitly and fully separately stated in your proposal. All exceptions, conditions, reservations, understandings or deviations will be evaluated by comparing it to the core requirements. If it is found to less than the minimum core requirements, MTS may view the proposal negatively and rate it accordingly.

The description of any proposed bus must follow the same format as these technical specifications. Your response to this specification must address each categorical requirement in the same proceeding order.

**DELIVERY**

This 40' low floor Compressed Natural Gas CNG bus specification covers a Contract for a five (5) year period with anticipated deliveries at the following rate:

- Year one (1) of the contract, MTS will purchase a minimum of twenty (20) or up to fifty (50) each 40' low floor transit buses as funding permits.
- Year two (2) of the contract, MTS will purchase a minimum of twenty (20) or up to fifty (50) each 40' low floor transit buses as funding permits.
- Year three (3) of the contract, MTS will purchase a minimum of twenty (20) or up to fifty (50) each 40' low floor transit buses as funding permits.
- Year four (4) of the contract MTS will purchase up to one hundred (100) each 40' low floor transit buses as funding permits.
- Year five (5) of the contract MTS will purchase up to one hundred (100) each 40' low floor transit buses as funding permits.

MTS anticipates confirming the initial order quantity immediately after the acceptance of an offer is issued, approximately September 2007. MTS expects delivery of the first article bus to take place in the month of July 2008. Any deviation from the delivery of the first article bus must be submitted for approval by MTS as described in Section 1.4. Year one (1) of the Contract will be for a minimum of twenty (20) or up to fifty (50) each 40' heavy duty transit buses. The base order shall include a first article (pilot bus), which shall be completed and delivered, with production beginning after a lapse of at least thirty (30) days after delivery of first article. First article requirement shall apply for each year of the base order. See attachment one (1) for further details.

For Contract years two (2) through five (5) MTS would determine by January 30<sup>th</sup>, the quantity of buses to be produced that year. MTS would require a firm production schedule. Your proposal must include a delivery plan. Your plan must describe all of the order processing and timing constraints MTS must follow when ordering buses.

### **6.1 TECHNICAL REQUIREMENTS FOR THE BASIC BODY**

These technical specifications define requirements for a heavy duty, 40' low floor Compressed Natural Gas (CNG) powered transit bus, which shall be used for service on urban arterial streets. It shall have a minimum expected life of twelve (12) years or 500,000 miles which ever comes first and is intended for the widest possible spectrum of passengers, including children, adults, the elderly, and persons with disabilities. These 40' buses shall have two (2) doors, one (1) ahead of the first axle, and one (1) ahead of the drive axle.

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

### **6.2 WEIGHT OF BUS**

Total vehicle weight including a minimum of thirty-seven (37) seated passengers plus allowing for fifty (50%) percent standees shall not exceed California State Law regulations regarding rated load carrying capacity of axles. Buses must comply with 23 C.F.R. part 658 of the Federal Department of Transportation Regulations and California Vehicle Code Weight Sections 35550 - 35558. Buses not meeting these criteria will not be accepted.

During final inspection, the buses will be weighed. Buses exceeding the gross vehicle weight as stated on the bus specifications sheet, submitted with your proposal, will be assessed a penalty of \$2.00 per pound for each pound over the stated weight. Buses exceeding California Weight limit may not be accepted.

### **6.3 PROPULSION UNIT**

The propulsion unit will be located in the rear of the bus in a T-drive configuration.

#### **6.4 EXTERIOR PANELS**

Roof and crown panels shall be aluminum or fiberglass. Crown panel over entrance door shall be steel with steel inner reinforcement. Body side panels shall be of .080 inch thick aluminum or steel. Exit door shall be reinforced with heavy structural steel.

#### **6.5 ALL SKIRT PANELS**

Skirt panels below rub-rail can be of Kevlar, aluminum or fiberglass construction. Rear structure above the floor line shall consist of an aluminum/steel bulkhead which separates the passenger compartment from a rear upper component compartment. The inside of this bulkhead shall be covered with black carpet or fabric that is graffiti resistant. Edges of carpet material shall have trim or moldings to prevent passengers from peeling it off.

The engine compartment door shall be .063 inch aluminum hinged at the top with a stainless steel piano type hinge across the entire length of door. Two (2) gas (pneumatic) cylinder door props shall be provided on all service compartment doors and the air conditioner compartment door. Side closure door shall be hinged at top with stainless steel piano type hinge. All access doors will be secured with square key locks. All service compartments shall provide service lights to aid the mechanics when servicing bus on the road. All fasteners shall be treated to prevent corrosion.

The front and rear license plate bracket shall be flush mounted. Front license plate, which cannot be obstructed by bike rack, shall be mounted on the front of bus over curbside turn signal lamp.

In no case will aluminum exterior body panels less than .063 inch be acceptable.

#### **6.6 METAL PROTECTION**

All metal panels and structural members shall be protected from rust and corrosion by thorough pretreatment prior to assembly operations. All frame tubing below the window line shall be sprayed internally with an anticorrosion compound. This may include chemical treatment and prime painting as required to insure this protection.

Caulking compound shall be used to seal interior body seams, joints and overlapping panels against water, dust, moisture and foreign matter. The sealant shall also be suitable for protection against electrolysis between dissimilar metals. A sealant containing a chromate inhibitor is to be used.

Prior to final painting and detailing of the surface, the body shall be cleaned and spot-primed to protect bare spots, and a surface sealant shall be applied to insure paint adhesion.

The bus flooring, sides, roof, understructure, axle suspension components shall resist corrosion or deterioration from atmospheric conditions and road salts for a period of twelve (12) years or 500,000 miles which ever comes first. It shall maintain structural integrity and nearly maintain original appearance throughout its service life, provided that it is maintained by the Procuring Agency in accordance with the procedures specified in the Contractor's service manual. With the exception of periodically inspecting the visible coatings applied to prevent corrosion and reapplying these coatings in limited spots, the Contractor shall not require the complete reapplication of corrosion compounds over the life of the bus.

#### **6.7 NOISE LEVELS - INTERIOR NOISE LEVEL**

The combination of inner and outer panels and any material used between them shall provide sufficient sound insulation so that an exterior sound source having up to an 80 dB sound level measured at the outside skin of the bus shall have a sound level of 65 dB or less at any point in the interior of bus. These conditions shall prevail with all openings, including doors and windows, closed and with the engine and all accessories switched off. The vehicle-generated noise level experienced by a passenger at any seat location in the bus shall not exceed 83 dB and the operator shall not experience a noise level of more than 75 dB under the following test conditions. The bus shall be empty except for test personnel, not to exceed four (4) persons, and the test equipment. All openings shall be closed and all accessories shall be operating during the test. The bus shall accelerate at full throttle from a standstill to 35 mph on a level, smooth, urban arterial road or highway in an area free of large reflecting surfaces within fifty (50') feet of the bus 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.

#### **6.8 EXTERIOR NOISE LEVEL**

Airborne noise generated by the bus and measured from either side shall not exceed 83 dB under full power acceleration when operated at or below 35 mph at curb weight. The maximum noise level generated by the bus pulling away from a stop at full power shall not exceed 83 dB. The bus-generated noise at curb idle shall not exceed 65 dB. All noise readings shall be measured at a distance of fifty (50') feet from and perpendicular to the center of the lane of travel with all accessories operating. Instrumentation, test sites, and other general requirements shall conform to SAE Standard J366. The pull-away test shall begin with the front bumper even with the microphone. The curb idle test shall be conducted with the rear bumper even with the microphone.

#### **6.9 MISCELLANEOUS FASTENERS**

All bolts, nuts, washers, clamps, clips and like parts installed by Contractor shall be stainless steel, zinc cadmium plated, or phosphate coated to prevent corrosion. Manufacturer shall be located in the USA or Canada.

## **DOORS**

### **6.10 DOORS - PASSENGER DOORS TYPE**

Front door shall be double-stream, slide-glide type. Rear door shall be power open, power close slide-glide type.

### **6.11 EMERGENCY DOORS OPERATION**

In the event of an emergency, it shall be possible to open the front and rear passenger doors manually from inside the bus using a force of no more than twenty-five (25) pounds after actuating an unlocking device at each door. The unlocking devices shall be clearly marked as "Door Emergency Release." The unlocking devices shall be clearly marked as an emergency only device and shall require two (2) distinct actions to actuate. The emergency door unlocking devices shall be accessible from the stepwell areas.

When these emergency devices are actuated, the door brake interlock system shall apply to stop the bus, regardless of the position of the door master switch.

Locked doors shall require a force greater than one hundred fifty (150) 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 or complex mechanism.

### **6.12 REAR DOOR OPENING FORCE**

An opening rear door shall impose no more than a fifteen (15) pound force on a one square (1") inch area of any passenger struck by it. A maximum force of thirty-five (35) pounds shall be required for passengers to free themselves after having either door open on them.

### **6.13 CLOSING DOOR FORCE**

Closing door edge speed shall not exceed nineteen (19") inches per second. The power close rear doors shall be equipped with a sensitive edge and an obstruction sensing system such that if an obstruction is struck or sensed by a closing door edge, the doors will stop and/or reverse direction prior to imparting a ten (10) pound force on one (1") square inch of that obstruction. Whether or not the obstruction sensing system is present or functional it shall be possible to withdraw a one and one-half (1½") inch diameter cylinder from between the center edges of a closed and locked door with an outward force not greater than thirty-five (35) pounds.

**6.14 DOOR MASTER SWITCH**

A door master switch shall be located in a compartment at the front of the bus which must be able to be opened without tools. This switch shall shut off the electrical circuits to the rear door, and the rear door interlocks in the event of a malfunction of the door or interlock controls. With this master switch in the "OFF" position, the rear door remains locked and the interlocks do not function. The switch does not affect non-door interlocks from functioning. The switch does not affect the operation of the front door or rear door emergency exit operation.

**6.15 DOOR DIMENSIONS**

When open, the doors shall leave an opening no less than seventy-six and one-half (76½") inches in height. Front door shall have a minimum clear opening width of thirty-two (32") inches for the entire vertical height of the door.

**6.16 DOOR GLAZING**

The upper section of rear doors shall be glazed for no less than forty-four (44%) percent of the respective door opening area of each section. The front door shall be glazed with a full length single glass section from top of door to bottom. The edge of a six (6") inch high curb shall be visible to the seated driver through the closed front door when the bus is more than twelve (12") inches from the curb. Front and rear door windows shall be glazed with "Heat Guard" product as manufactured by Transit Products and Services of Banning, CA, or approved equal. Glazing shall be ¼" inch tempered safety glass conforming to FMVSS 205 and applicable requirements of ANSI Z26.1-1997 and the Recommended Practices defined in SAE J673. The total visible light transmittance must not be below seventy-six (76%) percent as measured by ASTM E-424. The LSG (light to solar gain ratio) must be a minimum of 1.28. The reflective heat gain must meet a minimum requirement of 150 BTU/hr/sq.ft.

**Rear door glazing tint shall match that of side passenger windows.**

**6.17 DOOR HEIGHT ABOVE PAVEMENT**

It shall be possible to open and close passenger doors when the bus, loaded to GVWR, is not kneeled and parked with the curbside tires touching an eight (8") inch high curb on a street sloping toward the curb so that the street-side wheels are five (5") inches higher than the curbside wheels.

**6.18 FRONT DOOR**

Front door on the curbside ahead of the front wheelhouse shall be anodized aluminum, two (2) section slide-glide type. Door hinges shall be stainless steel, joints shall be covered with rubber waterproofing seals.

Door shall be operated from a door control actuator at roadside of driver, which controls a Vapor, or approved equal, pneumatic differential door engine mounted in compartment over door. A light with switch shall be provided in the door compartment to assist mechanics. Access door to compartment shall be hinged at the top and fastened with two (2) rotating knob-type latches.

**6.19 FRONT DOOR AIR DUMP VALVE**

An air dump valve so connected as to supply and/or exhaust all air from the front door engine, shall be provided. With valve in "OFF" position, front door can be opened and closed manually. Air dump valve shall be installed at the left of the operator's position and shall display the following operating instructions:

**TURN HANDLE TO "OFF" FOR OPENING FRONT DOORS MANUALLY.**

**6.20 REAR EXIT DOORS**

The rear exit door shall be an aluminum two (2) section "power open, power close" slide-glide type door. A light with switch shall be provided in the door compartment to assist mechanics. The exit door of the vehicle shall be equipped with an acoustic sensing system to secure passenger and other objects in the door way and between the fully opened or partially closed door panels. The Acoustic Sensing System shall be the "CLASS SYSTEM" manufactured by Vapor Bus International, or approved equal.

**6.21 DOOR PROJECTION**

Exterior projection of the doors shall be minimized and shall not exceed six and one-half (6½") inches during the opening or closing cycles or when doors are fully opened. Projection inside the bus shall not exceed twenty (20") inches. The closing edge of each door panel shall have no less than two (2") inches of soft weather stripping. The doors when closed shall be effectively sealed and the hard edges of the doors shall be at least four (4") inches apart.

**6.22 FRONT AND REAR DOOR CONTROL**

The door control actuator shall operate the front and rear doors separately or simultaneously. A Vapor five (5) position door control, or approved equal, shall be mounted to the left of the driver positioned forward from center of the steering column. The control lever positions shall be as follows:

<u>LEVER POSITION</u>	<u>FRONT DOOR</u>	<u>REAR DOORS</u>
Extreme Forward:	Open	Open
1 <sup>st</sup> Position Forward:	Open	Closed
Center Position:	Closed	Closed
1 <sup>st</sup> Position Rear:	Closed	Open
Extreme Rear:	Open	Open

**Operator shall have full control of rear exit doors opening and/or closing function.**

The door control actuator, dump valve, and adjacent parts shall be accessible through the front exterior electrical panel and/or interior side console.

## **SERVICE COMPARTMENTS AND ACCESS DOORS**

### **6.23 EXTERIOR SERVICE COMPARTMENTS AND ACCESS DOORS**

Conventional hinged doors with stainless steel piano type hinges shall be used for the engine compartment and for all auxiliary equipment compartments including doors for checking the quantity and adding to the engine coolant and the windshield washer reservoir. Windshield washer reservoir fill door shall be in the front of the bus. Access to all other compartments shall be from the outside rear of the bus. Coolant shall be added through the same access doors as the quantity is checked. The surge tank access door shall be adequately sized for ease of accessibility.

No separate access doors shall be provided on the engine compartment door for the engine oil and transmission fluid dipsticks.

These shall be serviced through the main engine compartment door. Access openings shall be sized for easy performance of tasks within the compartment including tool operating space. Access doors shall be of rugged construction and shall be capable of withstanding severe abuse throughout the life of the bus. They shall close flush with the body surface. All access doors shall be prevented from coming loose or opening during transit service or in bus washing operations. All access doors shall be retained in the open and closed position by counterbalancing with over-center or gas filled struts. Springs and hinges shall be corrosion resistant and shall last over the bus's service life. The utilization of 5/16" inch square key latches where necessary are permitted. Access doors shall hinge up and out of the way or fold flat against the bus body and shall be easily operable by one person. These doors, when opened, shall not restrict access for servicing other components or systems and must provide service lights.

Rear engine door shall be latched closed by use of flush mounted square key latch mechanisms. The street-side gas support strut shall have a locking mechanism that locks in the open position. Rear engine door shall incorporate an exterior handle mounted to lower center of door, as well as, an interior handle mounted off center on street-side. A hinged and removable belt guard shall be provided, with a latching device, for easy access to engine belts, pulleys and accessories.

Undercarriage steering box access doors must be hinged for easy access and shall be latched closed by use of flush mounted square key latch mechanisms.

Curbside battery compartment door shall have a minimum of six hundred (600") square inches of expanded steel, screen and other opening to aid in heat removal from the engine compartment.

Any hinged skirt panel is considered to be an access door for the purposes of this section.

### **6.24 UNDERBODY**

Any underbody inspection covers shall be hinged and utilize square key latches. Inspection covers using screws is not acceptable.

**6.25 INTERIOR**

Rear bulkhead shall have access panels on curbside and street-side. Access panels shall be minimum 18"x18" in size.

**6.26 WINDSHIELD WIPERS AND WASHERS**

The bus shall be equipped with an electric operated Sprague, or approved equal, variable speed windshield wiper for each half of the windshield. Separate controls for each side shall be supplied. A variable intermittent feature shall be provided to allow adjustment of wiper speed between approximately 5 to 25 cycles per minute.

Wiper motors and arms shall be of the type to provide maximum visibility for the operator and shall not obstruct operators view when wipers are parked. No part of the windshield wiper mechanism shall be damaged by manual manipulation of the arms. At 60 mph, no more than ten (10%) percent of the wiped area shall be lost due to windshield wiper lift. Windshield wiper motors and mechanisms shall be easily accessible for repairs or service and shall be removable as complete units. Exposed hardware such as bolts and bushings shall be stainless steel or otherwise corrosion resistant.

Windshield washer system, when used with the wipers, shall deposit washing fluid evenly and completely wet the entire wiped area. The windshield washer shall incorporate an electric type pump. The windshield washer reservoir shall be mounted at the front of the bus with provision for exterior fill through a small swing-open door at the front of the bus. Reservoir shall be a translucent plastic for easy determination of fluid level with a minimum capacity of two (2) U.S. gallons.

Windshield washer spray nozzles shall be located separately from the windshield wiper arms.

**WINDOWS****6.27 WINDSHIELD**

The windshield shall permit an operator's field of view as referenced in SAE Recommended Practice J1050. The vertically upward view shall be a minimum of fifteen (15°) degrees, measured above the horizontal and excluding any shaded band. The vertically downward view shall permit detection of an object three and one-half (3½') feet high no more than two (2') feet in front of the bus. The horizontal view shall be a minimum of ninety (90°) degrees above the line of sight. Any binocular obscuration due to a center divider may be ignored when determining the ninety (90°) degree requirement, provided that the divider does not exceed a three (3°) degree angle in the operator's field of view. Windshield pillars shall not exceed ten (10°) degrees of binocular obscuration. The windshield shall be designed and installed to minimize external glare as well as reflections from inside the bus.

The windshield shall be easily replaceable by removing zip-locks from the windshield retaining moldings. Bonded-in-place windshield shall not be used. The windshield glazing material shall have a ¼" inch or 6 mm nominal thickness laminated safety glass conforming to the requirements of ANSI Z26.1 Test Grouping 1A and the Recommended Practices defined in SAE J673. The glazing material shall have single density tint. The upper portion of the windshield above the operator's field of view shall have a dark, shaded band with a minimum luminous transmittance of six (6%) percent when tested in accordance to ASTM D-1003.

## **6.28 OPERATOR'S WINDOW**

The operator's side window shall be a full slider "3-Minute Window" without "Glass Guard" as manufactured by Riconcorp of Panorama City, CA, or approved equal. The operator's side window shall be glazed with "Heat Guard" product as manufactured by Transit Products and Services of Banning, CA, or approved equal. Glazing shall be ¼" inch laminated safety glass conforming to FMVSS 205 and applicable requirements of ANSI Z26.1-1997 and the Recommended Practices defined in SAE J673. The total visible light transmittance must not be below seventy-six (76%) percent as measured by ASTM E-424. The LSG (light to solar gain ratio) must be a minimum of 1.28. The reflective heat gain must meet a minimum requirement of 150 BTU/hr/sq. ft. The slider sections shall slide in tracks or channels designed to last the service life of the bus. The operator's side window shall open sufficiently to permit the seated operator to easily adjust the street-side rearview mirror. The seated operator shall have an unobstructed view of the street-side rearview mirror with window in the fully open or closed position. When in open position, the window shall not rattle or close during braking. The sliders shall be equipped with a pinch handle and catch located mid point on the riser of each slider. The operator's side window assembly shall not be bonded in place and shall be easily replaceable. The window design shall be similar to the passenger windows.

## **6.29 PASSENGER SIDE WINDOWS**

All passenger side windows shall be the "3-Minute Window" without "Glass Guard" as manufactured by Riconcorp, or approved equal. Passenger side windows in front portion of bus shall be bottom slider, top fixed, with the exception of the two (2) forward windows on each side, which shall be split fixed. Passenger side windows in rear portion of bus shall be full sliders. All aluminum and steel material shall be black anodized to help prevent corrosion.

A minimum of four (4) of the passenger windows in the front section of bus shall provide for emergency egress. Emergency egress and window operation instructions must be a metal plate permanently fixed to the bus sidewall. The instruction must be mounted within six (6") inches of the emergency handle. Operation instructions must be printed in both English and Spanish.

Windows shall be constructed to enable a maintenance worker to replace the glazing in three (3) minutes or less. Glazing in the assembly shall be replaced without removing the window from its installed position on the bus or manipulation of any rubber molding surrounding the glazing. The glazing shall be held in place by four (4) mechanical brackets. The mechanical brackets shall act as part of the structure of the window. All windows rear of exit door shall be equipped with "Scotchgard" 1004 Multi-Layer Protective Film for Glass with stepped edge as manufactured by 3M Industrial, or

approved equal. This optically transparent, pressure sensitive polyester film tape shall be designed to protect the interior of windows from intentional mutilation, scratching, and etching. A defaced layer shall have the ability to be quickly and easily removed, exposing a fresh protective sheet.

All passenger windows glazing shall be glazed with "Heat Guard" product as manufactured by Transit Products and Services of Banning, CA, or approved equal. Glazing shall be ¼" inch tempered safety glass conforming to FMVSS 205 and applicable requirements of ANSI Z26.1-1997 and the Recommended Practices defined in SAE J673. The LSG (light to solar gain ratio) must be a minimum of 1.28. The reflective heat gain must meet a minimum requirement of 150 BTU/hr/sq. ft. Windows on the bus sides and in the rear doors shall be equally tinted with a forty-four (44%) percent luminous transmittance grey color tint. Side destination sign window top section shall be clear.

## **MIRRORS**

### **6.30 GENERAL MIRRORS**

The bus shall be equipped with a corrosion-resistant, outside rearview mirror on each side of the bus. The mirrors shall permit the operator to view the highway along both sides of the bus, including the rear wheels. The mirrors are to be designed in such a way that allows for firm attachment to the bus to prevent vibration and loss of adjustment, but not so firmly attached that the bus or its structure is damaged when the mirror is struck in an accident. Mirrors shall retract or fold sufficiently to allow bus washing operations.

### **6.31 CURBSIDE MIRRORS**

The curbside mirror shall be a remotely adjustable 10"W x 11"H mirror as manufactured by Hadley-Elkhart (formally B&R Mfg.), or approved equal. The mirror is to be constructed of high impact Acrylonitrile Butadiene Styrene (ABS) plastic with a black finish. Mirror head shall be attached using a nitro-carbonizing ball and clamps onto a steel arm powder coated flat black. The mirror design is a friction mount construction that allows for the mirror assembly to be folded during bus washing or when incidental contact occurs. The operator shall be able to adjust flat or convex portion remotely while seated in the driving position. The control for the remote positioning of the mirror shall be a single or dual switch, or devise. The flat and convex mirror shall be electrically heated with heater being energized whenever the operator's heater and/or the defroster is activated. An LED turn signal shall be incorporated into the outside portion of the mirror to allow visibility from the rear of the vehicle. The mirror is to be top mounted on the side of the bus and shall be mounted so that its lower edge is no less than eighty (80") inches above the street surface with clear operator visibility through the wiper area of the windshield.

### **6.32 STREET-SIDE MIRRORS**

The street-side mirror shall be a remotely adjustable 10"W x 11"H mirror as manufactured by Hadley-Elkhart (formally B&R Mfg.), or approved equal. The mirror is to be constructed of high impact ABS plastic with a black finish. Mirror head shall be attached using a nitro-carbonizing ball and clamps onto a steel arm powder coated flat black. The mirror design is a friction mount construction that allows for the mirror

assembly to be folded during bus washing or when incidental contact occurs. The operator shall be able to adjust flat or convex portion remotely while seated in the driving position. The control for the remote positioning of the mirror shall be a single or dual switch, or devise. The flat and convex mirror shall be electrically heated with heater being energized whenever the operator's heater and/or the defroster is activated. An LED turn signal shall be incorporated into the outside portion of the mirror to allow visibility from the rear of the vehicle. The mirror is to be mounted on the side of the bus and shall be mounted so that its lower edge is no less than sixty-six (66") inches above the street surface with clear operator visibility through the side driver's window with the window closed or fully open.

### **6.33 INTERIOR MIRROR**

A fully adjustable Lucerix, or approved equal, 8" x 15" inch convex operator's rear view mirror with an approved type safety rim (black), shall be mounted just above the windshield to left of centerline.

Two (2) separate adjustable Lucerix, or approved equal, six (6") inch round flat mirrors with an approved type safety rim (black), shall be installed in combination (at right front of bus) to provide operator view of rear (exit) door and front mounted bike rack.

One (1) adjustable Lucerix, or approved equal, twelve (12") inch round convex mirror with an approved type safety rim (black), shall be installed at rear exit door.

### **6.34 WHEELHOUSES**

Wheel housings shall be minimum 14-gauge stainless steel. Front wheel housings covers shall be fiberglass "Gel-coated" glossy antique white to color match the ceiling. Scuff guards constructed of .050" thick stainless steel rising sixteen to eighteen (16" to 18") inches from floor level up around the base of front wheel house covers shall be provided. Scuff guards shall be secured with screws.

## **BUMPERS**

### **6.35 GENERAL BUMPERS**

Front and rear bumpers shall be Romeo Rim, or approved equal, three (3) piece, black energy absorbing bumpers. Rear Bumper shall be of the anti-ride type. Bumper height shall be such that when one bus is parked behind another, a majority portion of the bumper faces will contact each other. The front and/or rear bumper systems shall utilize the following materials and construction:

Energy absorbing modules are to be self-restoring, integral urethane. The back structure is to be fabricated with aluminum and provide a single full length, structural support for modules. The bumper construction shall provide for the disassembly and service of modules and structural components independently of one another.

### **6.36 FRONT BUMPER**

No part of the bus, including the bumper shall be damaged as a result of any 5 mph impacts with a fixed, flat barrier perpendicular to the bus' longitudinal centerline of the vehicle. The bumper shall return to its original shape within ten minutes of the impact.

The bumper shall protect the bus from damage as a result of 6.5 mph impacts at any point by the Common Carriage with Contoured Impact Surface defined in Figure 2 of FMVSS 301 loaded to 4,000 pounds parallel to the longitudinal centerline of the bus and 5.5 mph impacts into the corners at a thirty (30°) degree angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length by no more than seven (7") inches.

### **6.37 REAR BUMPER**

No part of the bus, including the bumper shall be damaged as a result of any 2 mph impacts with a fixed, flat barrier perpendicular to the bus' longitudinal centerline of the vehicle. The bumper shall return to its original shape within ten minutes of the impact. When using a yard tug with a smooth, flat plate bumper 2 feet wide contracting the horizontal centerline of the rear bumper, the bumper shall provide protection at speeds up to 5 mph, over pavement discontinuities up to 1 inch high, and at accelerations up to 2 mph/second. The bumper shall protect the bus from damage as a result of 4 mph impacts at any point by the Common Carriage with Contoured Impact Surface defined in Figure 2 of FMVSS 301 loaded to 4,000 pounds parallel to the longitudinal centerline of the bus or impacts into the corners at a thirty (30°) degree angle to the longitudinal centerline of the bus. The energy absorption system of the bumper shall be independent of every power system of the bus and shall not require service or maintenance in normal operation during the service life of the bus. The bumper may increase the overall bus length by no more than seven (7") inches. The bumper shall also provide an integral "Anti-Ride" geometry to preclude the possibility of standing on the bumper.

### **6.38 TOW EYES**

Two (2) tow eyes shall be installed at the front of the bus and at least one (1) at rear.

### **6.39 UNDERCOATING**

The entire understructure, including wheelhouses and step wells, but excluding the air dryer, air lines, air valves and axles, shall be spray coated with a heavy duty Tectyl #185, or approved equal, aluminum pigmented, non-flammable, corrosion preventive compound. Particular attention should be directed to areas of water, salt and foreign matter collection and compaction on the underside of the bus.

### **6.40 SPLASH APRONS AND FENDERS**

Exterior front and rear wheelwell splash aprons (mud flaps) shall be fabricated of rubber and/or rubber and fiber composition. Splash aprons shall be minimum ¼" inch thick and shall be installed behind front and rear wheels and extend to within two and one-half (2½") inches of ground. Rear axle splash aprons shall be of three (3) piece construction and extend full width of bus with a large center section protecting the open transmission bay. Molded rubber fenders shall be installed at front and rear wheelhouses.

## INTERIOR BODY SPECIFICATIONS

### 6.41 FLOOR

The floor design shall consist of two (2) levels (bi-level construction). Aft of the rear door extending to the rear settee riser, the floor height may be raised to a height approximately eighteen (18") inches above the lower level. An increase slope shall be allowed on the upper level not to exceed three point five (3.5°) degrees off the horizontal. Where the floor meets any vertical surfaces, such as, platform risers, the surface edges shall be blended with a circular section of radius not less than one (1") inch. Similarly, a molding or cove shall prevent debris accumulation between the floor and the wheel housings. The vehicle floor in the area of the entrance and exit doors shall have a lateral slope not exceeding two (2°) degrees to allow for drainage.

The floor material shall be ¾" inch, pressure-treated 7-ply plywood with a preservative chemical that prevents decay and damage by insects. Preservative chemicals shall contain no EPA listed hazardous chemicals. Plywood shall be installed with the highest grade veneer up. Pressure treated plywood shall have a moisture content at or below fifteen (15%) percent. A barrier shall be installed to prevent contact by road salt with the plywood panels. Shaped and cut edges shall be sealed with linseed oil and titanium dioxide.

Floor may be integral with the basic structure or mounted on the structure securely, using corrosion resistant fasteners, to prevent chafing or horizontal movement and designed to last the life of the bus. Sheet metal screws shall not be used to retain the floor and all floor fasteners shall be serviceable from one side only. The use of adhesives to secure the floor to the structure shall be allowed only in combination with the use of bolt or screw fasteners and its effectiveness shall last throughout the life of the bus. Tapping plates, if used for the floor fasteners, shall be no less than the same thickness as a standard nut and all floor fasteners shall be secured and protected from corrosion for the service life of the bus. The floor deck shall be reinforced as needed to support passenger loads. At GVWR, the floor shall have an elastic deflection of no more than 0.60 inches from the normal plane. The floor shall withstand the application of two point five (2.5) times gross load weight without permanent detrimental deformation. Floor with coverings applied, shall withstand a static load of at least one hundred fifty (150) pounds applied through the flat end of a ½" inch diameter rod, with 1/32" inch radius, without permanent visible deformation. Any gaps and fastener heads shall be caulked and sanded prior to application of adhesive for floor covering.

### 6.42 FLOOR COVERING

All floor covering shall be 2.7 mm transit grade flooring material, TFCR27MTS Grey, as manufactured by Altro Transflor, or approved equal. Floor covering shall be installed to all floor areas up to bottom of seat rail including driver platform and riser, rear deck riser, rear settee riser, rear wheel housings, and tops of front wheel housings. A trim railing shall be installed that overlaps top edge of floor covering along seat rails from front wheel housings to rear door on curbside and to rear deck riser on street-side. A stainless steel trim ring shall also be installed around floor covering material on top of front wheel housings and around any inspection openings, such as on driver's platform riser.

A two (2") inch wide by 2.7 mm thick yellow standee line shall be provided to separate passenger boarding entrance area from bus proper and a twenty-one to twenty-nine (21" to 29") inch wide by 2.7 mm thick yellow step area shall be provided at the rear door using Altro Transflor TFM2729 Yellow, or approved equal. Nosings at outside edge of entrance and exit door, and at rear steps to upper deck, shall utilize Altro Transflor, yellow vinyl nosings, or approved equal. Entire plywood area shall be thoroughly sanded and cleaned prior to application of adhesive. Double faced bond technique shall be employed, i.e. adhesive shall be applied to back side of floor covering and wood floor so as to provide a permanent bond that will remain bonded for the service life of the bus.

***The floor covering shall be seamless or seams shall be permanently sealed so as to eliminate the permeation of water to the wood flooring.*** Any seams shall be butted and bevel cut in preparation for welding of seams. Trim moldings shall be utilized on any exposed edges of floor covering material and shall be fabricated from stainless steel or anodized aluminum.

#### **6.43 INTERIOR PANELS**

Interior panels for the headlining and the areas between the windows from window line up to the ducting/lighting fixtures shall be 1/10" inch thick, hard-faced Melamine panels. Pattern/color for ceiling (headlining) panels shall be antique white S-463 gloss finish one (1) side, pier panel mullions shall be antique white S-463 gloss finish one (1) side. Sidewall panels from window line down to seat rail shall be leather grained aluminum.

Panels shall be heat and scratch resistant with hard board back. Panel joints shall be trimmed with stainless steel strips. Other trim strip materials shall be treated to resist rust, corrosion and other weathering and aging effects.

The front crown panel, driver's area and doors shall be painted non-glare black acrylic enamel. Dashboard upper section shall be smooth black metal or fiberglass construction. Lower area of the dash shall be painted non-glare black acrylic enamel. Rear wall above seat back shall be a black Holdsworth, or approved equal, vandal resistant material and shall require trim or molding on edges to prevent passengers from peeling it off.

#### **6.44 MODESTY PANELS**

Modesty panels shall be provided along front edge of rear upper level on both the curbside and street-side. Panel material shall be 0.060 inch leather grain finish aluminum. Panels shall utilize a metal edge trim on top, bottom, and inboard edges. Inboard edge of panels shall be attached to vertical aisle stanchions, outboard edge of panels shall be attached to bulkheads, and top/bottom edges of panels shall be attached to horizontal grab rails, which shall themselves be attached to bulkheads and aisle stanchions. The inboard edge of panels shall be attached to vertical stanchions in the same manner as are the top and bottom edges. Panels shall extend to within two and one-half and three (2½ " to 3") inches of floor to facilitate cleaning.

Sturdy barrier panels as manufactured by Transit Products and Services, or approved equal, shall be provided on curbside forward and aft of exit door to protect passengers on adjacent seats. Barriers shall be approximately sixteen to eighteen (16" to 18") inches in width and shall extend high enough to prohibit passengers from getting an arm or hand caught by the door during opening and/or closing function. The panel frame

shall be constructed of durable 6063 T5 aluminum and shall be finished with a corrosion-resistant safety yellow powdercoating that will compliment the interior trim. The glazing installed in barrier panels shall be ¼" inch thick tempered safety glass and shall be easily replaced in under four (4) minutes. Glazing must be replaceable without removing the panel from its mounting or disturbing the mounting hardware. Exit door barrier panels shall be of quick change design enabling a maintenance worker to replace glazing by removing one piece of aluminum frame that is held in place by only two (2) stainless steel fasteners. Glazing shall be protected on both sides with "Scotchgard" 1004 Multi-Layer Protective Film for Glass with stepped edge as manufactured by 3M Industrial, or approved equal. This optically transparent, pressure sensitive polyester film tape shall be designed to protect the glazing from intentional mutilation, scratching, and etching. A defaced layer shall have the ability to be quickly and easily removed, exposing a fresh protective sheet.

#### **6.45 ROOF ESCAPE/VENTILATION HATCH**

Two (2) low profile combination roof escape and ventilation hatches as manufactured by Transpec Worldwide, or approved equal, shall be provided. The hatches shall be located approximately over front and rear axles. The hatch opening shall be not less than twenty-three by twenty (23" x 20") inches and shall have four (4) positions for ventilation. When open with the bus in motion, this ventilator shall provide fresh air inside the bus and be capable of being positioned as a scoop with either the leading or trailing edge open no less than four (4") inches, or with all four edges raised simultaneously to a height of no less than three and one-half (3½") inches. Roof hatches shall be sealed to prevent entry of water when closed and shall incorporate a lever type handle for emergency exit release. Hatches shall be labeled as emergency exits with operating instructions, which shall be clearly visible in English and Spanish.

#### **6.46 PASSENGER SEATING AND CAPACITY**

All seats shall be "Insight" model with vandal resistant VR-50 upholstered inserts throughout, as manufactured by American Seating Company, or approved equal. The seating arrangement shall provide the maximum number of seats possible using a minimum twenty-eight (28") inch hip to knee room spacing. There shall be no less than thirty-seven (37) total seats including the two (2) wheelchair tie down area seats. All seats in the front lower section of bus shall be forward facing two (2) seat transverse type cantilever mounted, with the exception of two (2) longitudinal type seats for elderly/handicap passengers in extreme forward positions. All elderly/handicap and wheelchair seats shall fold up and lock in the up position only. All forward facing seats shall have integral stainless steel grab rails at top of seat back and stainless steel back panels. Rear settee is to be separated in a 1-3-1 configuration and hinged separately for access to the engine compartment. All seats must meet or exceed FMVSS requirements and must conform to the same for installation requirements.

#### **Perimeter seating is required on upper deck from the rear door to the back of the bus.**

Seat plastic trim shall be 980 Gray in color and VR-50 inserts shall have Holdsworth BFNR 28724 red color material. Two (2) wheelchair tie-downs equipped with **Advanced Restraint Module (A.R.M.)** from American Seating with QRT deluxe retractor by Q-Straint, or approved equal. All wheelchair seating/layouts must meet or exceed ADA requirements.

#### 6.47 OPERATOR'S SEAT

The operator's seat shall be a premium quality Recaro Ergometro Model AM80, or USSC Q91 Series (w/o side bolsters), or approved equal. The driver's seat shall be comfortable and adjustable so that persons ranging in size from the 95<sup>th</sup> percentile male to the 5<sup>th</sup> percentile female may operate the bus. While seated, the operator shall be able to make seat adjustments by hand without complexity, excessive effort, or being pinched. Adjustment mechanisms shall hold the adjustments and shall not be subject to inadvertent changes. The angle formed between the seat back and the seat cushion shall be adjustable from a minimum of no more than ninety (90°) degrees (upright) to at least one hundred five (105°) degrees (reclined), with infinite adjustment in between. Height of the seat shall be adjustable so that the distance between the top of the uncompressed seat cushion and the floor may vary between a minimum of fourteen (14") inches to a maximum of twenty (20") inches, with a minimum of a six (6") inch range of adjustment. It shall have a minimum of nine (9") inches of adjustment in the fore and aft direction without contacting any bus part. The seat cushion shall also be adjustable. The seat pan cushion shall adjust in its slope from no less than plus twelve (12°) degrees (rearward "bucket seat" incline), to no less than minus five (5°) degrees (forward slope). The seat shall be installed in the same location in all buses. The operator's seat shall be appropriately dampened to support a minimum weight of three hundred eighty (380) pounds and incorporate a dynamic load damper to augment the springing and padding in the cushions. Rubber bumpers shall be provided to prevent metal-to-metal contact if the seat "bottoms out." Any electrical and/or air connections to the seat shall have quick disconnect provisions to allow easy removal and replacement of the seat. Seat back and seat cushion shall be black upholstery fabric on center portion of seat face, with black vinyl on sides and edges, and no welt cord shall be used. Foam shall be molded polyurethane with pneumatic lumbar support and pneumatic suspension system. Seat cushions shall be of long-lasting, polyurethane non-fire resistant foam. Particular attention shall be given to providing a seat which is comfortable in warm, humid weather and which give full consideration to long periods of occupancy. Operator's seat shall be mounted so that it can be removed by the maintenance personnel, by one (1) mechanic, in one-half (½) hour for service or repair. This may include the use of captive fasteners to preclude the necessity for two (2) mechanics to perform the procedure.

**The operator's seat shall be equipped with a fully retractable seat belt and separate shoulder harness restraint system. The shoulder harness and seat belt shall provide full adjustment of each strap.** The belts shall be fastened to the seat so that the operator can adjust the seat without resetting the seat belt. Seat belts shall be stored in automatic retractors. This system shall not incorporate inertia type retractors. The seat belt shall extend from left to right and shall have a usable travel of at least sixty (60") inches measured from the open end of the protective boot to the end of the buckle or latch plate.

#### 6.48 OPERATOR AREA/DASH PANEL

The operator's work area shall be designed to minimize glare to the extent possible. Objects within and adjacent to this area shall be matte black in color wherever possible to reduce the reflection of light onto the windshield. The use of polished metal and light-colored surfaces within and adjacent to the operator's area shall be avoided. Such objects include dash panels, switches and controls, cowlings, barriers, access panels,

window frames, visors, etc. Any interior lighting forward of standee line shall be controlled by the operator. A dash route/fare card holder, operator's storage compartment, an 8-pocket acrylic Plexiglas® route map holder (see Operator Barrier section below), radio/GPS antenna access, and waste baskets shall be furnished and installed by manufacturer. Additional provisions for operator's area are included below

#### **6.49 OPERATOR BARRIER**

The operator's barrier shall be a smooth, esthetically pleasing design, providing the appearance of an integral unit as opposed to a conglomeration of different constructive elements. The operator's barrier shall be constructed so that radio/camera equipment box, driver's storage box, schedule holder, and associated equipment are one integral unit. The design and construction of the operator barrier shall require MTS approval.

#### **6.50 DOCUMENT HOLDER**

An acrylic Plexiglas® holder designed to hold vehicle registration and/or insurance documents shall be provided. Holder shall be approximately 10" x 10" inches in size and be mounted in driver's area.

#### **6.51 OPERATOR'S COAT HOOK**

A stainless steel coat hook, with ball and separate strap, shall be provided and mounted in operator's area such that when in use does not interfere with driving operation or obstruct the driver's view.

#### **6.52 OPERATOR'S STORAGE LOCKER**

An operator's storage locker shall be provided. Storage locker shall be designed and integrated into the operator's barrier. Storage locker for the operator shall be approximately 18" x 18" x 18" in size and shall include a door with a latch. Design of locker will require MTS approval.

#### **6.53 VISOR**

One (1) padded sun visor shall be provided for the driver's side of the windshield. Visor shall be shaped and sized adequately to minimize light leakage between the visor and windshield pillars. Visor shall store out of the way and shall not obstruct air flow from climate control system or interfere with other equipment such as the radio handset or destination sign control. Sun visor construction and materials shall be strong enough to resist breakage during adjustments.

One (1) padded sun visor shall be provided for the driver's side window. Visor shall be shaped and sized adequately to minimize light leakage between the visor and operator's window. Visor shall store out of the way and shall not obstruct air flow from climate control system or interfere with other equipment such as the radio handset or destination sign control. Sun visor construction and materials shall be strong enough to resist breakage during adjustments.

## **PASSENGER ASSISTS**

### **6.54 GENERAL PASSENGER ASSIST**

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 95<sup>th</sup> percentile male and the 5<sup>th</sup> percentile female standee. Starting from the entrance door and moving anywhere in the bus and at 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 5<sup>th</sup> percentile female passenger may easily move from one assist to another using one hand and the other without losing support. All passenger assists in the front door and vestibule shall be powder coated bright yellow to aid visually impaired passengers.

Interior handrails and stanchions shall permit sufficient turning and maneuvering space for wheelchairs and other mobility aids to reach a securement location from the ramp.

Handrails and stanchions shall be provided in the entrance to the vehicle in a configuration which allows person with disabilities to grasp such assists from outside the vehicle while starting to board, and to continue using such assists throughout the boarding and fare collection process. Handrails shall have a cross-sectional diameter between one and one-quarter and one and one-half (1¼" and 1½") inches or shall provide an equivalent grasping surface, and have eased edges with corner radii of not less than ¼" inch. Handrails shall be placed to provide a minimum one and one-half (1½") inches knuckle clearance from the nearest adjacent surface. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the boarding procedure. Passengers shall be able to lean against the assist for security while paying fare.

### **6.55 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 shall be fitted with assists at modesty panel to aid in the exiting of passengers. A 5<sup>th</sup> percentile female shall be provided assists that are functionally continuous during the entire exiting process and the assists shall be no more than four (4") inches from the outside edge of the lower step tread.

A full-size vertical assist that is functionally continuous with the overhead assist shall be provided on the aisle side of the modesty panels at the step wells. A full-size assist no less than thirty-six (36") inches above the average step tread surface shall be provided in the middle of the rear door step well extending from the aisle to the outside edge of the lower step.

### **6.56 VESTIBULE**

The aisle side of the operator's barrier, the wheel housings and when applicable the modesty panels shall be fitted with vertical passenger assists panels that are functionally continuous with the overhead assist and that extend to within thirty-six (36") inches of the floor. These assists shall have sufficient clearance from the barrier to prevent

inadvertent wedging of a passenger's arm or hand. A horizontal passenger assist shall be located across the front of the bus and shall prevent passengers from sustaining injuries on the windshield in the event of a sudden deceleration. Without restricting the vestibule space, the assist shall provide support for a boarding passenger from the front door through the fare collection procedure. The front door assist shall be no less than thirty-six (36") inches above the floor or the average step tread surface. The assists at the front of the bus shall be arranged to permit a 5<sup>th</sup> percentile female passenger to easily reach from the door assist, to the front assist, to vertical assists on the operator's barrier, wheel housings, or front modesty panel.

## **6.57 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 seventy-two (72") inches above the floor. Overhead assists shall simultaneously support one hundred fifty (150) pounds on any twelve (12") inch length. No more than five (5%) percent of the full grip feature shall be lost due to assist supports.

Overhead handrails shall be provided which shall be continuous except for a gap at the rear doorway.

Handrails and stanchions shall be sufficient to permit safe boarding, on-board circulation, seating and standing assistance and alighting by persons with disabilities.

The vertical stanchion immediately behind the driver shall either terminate at the lower edge of the aisle-facing seats, if applicable, or be "dog-legged" so that the floor attachment does not impede or interfere with wheelchair footrests. If the driver seat platform must be passed by a wheelchair or mobility aid user entering the vehicle, the platform, to the maximum extent practicable, shall not extend into the aisle or vestibule beyond the wheel housing.

The minimum interior height along the path from the lift to the securement location shall be seventy-two (72") inches.

A crash resulting in a one (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. Any joints in the assist structure shall be underneath supporting brackets and securely clamped to prevent passengers from moving or twisting the assists. All components of the passenger assists including functional components shall be of anodized aluminum or stainless steel. Assists shall withstand a force of three hundred (300) pounds applied over a twelve (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 flush with the surface and free of rough edges.

**6.58 FRONT DOORWAY**

Front doors, or the passenger entry area, shall be fitted with ADA compliant assists. Assists shall be as far outward as practicable, but shall be no further than four (4") inches from the outside edge of lower step tread, shall provide a near vertical hand grip at the outer edge of the door, and shall be easily grasped by a 5<sup>th</sup> percentile female boarding from street level. Door assists shall be functionally continuous with the horizontal front passenger assist and the vertical assists and the assists on the wheel housing or on the front modesty panel.

**6.59 LONGITUDINAL SEATS**

Longitudinal 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 practicable and shall be no more than fifty-two (52") inches apart or be functionally continuous for a 5<sup>th</sup> percentile female passenger. (Configuration of assists shall be reviewed/determined at the pre-production meeting with final configuration approval by MTS).

**6.60 ADDITIONAL VERTICAL ASSISTS**

Up to eight (8) vertical passenger assists shall be installed at the aisle side of forward facing seats from the seat grab handle to the overhead passenger assist. (Configuration of assists to be reviewed/determined at the pre-production meeting with final configuration approval by MTS).

**PAINTING AND LETTERING****6.61 GENERAL PAINTING AND LETTERING**

Color numbers, color chips, locations, typeface, logo grid, drawings and specifications for all interior and exterior requirements will be furnished to the bus manufacturer at pre-production meeting.

**6.62 EXTERIOR PAINT**

The exterior of the bus shall be painted with up to two (2) colors and be of polyurethane paint which is baked dry (actual colors to be provided at pre-production meeting). The bus manufacturer will provide line drawings of the front, rear, driver's side and passenger side to MTS. MTS will illustrate the colors and their locations for the manufacturer's name and number of the paints.

**6.63 ROOFTOP NUMBERS**

1. There will be a four (4) digit rooftop number on each bus. Numbering shall be determined at pre-production meeting.
2. All numbers shall be black decals; edge sealed and shall be block style.
3. Numbers shall be located on rooftop to rear of canopy and shall read from street-side to curbside centered across bus.

4. Numbers shall be minimum:

- |    |                        |     |
|----|------------------------|-----|
| A) | Height:                | 30" |
| B) | Width:                 | 16" |
| C) | Width of Print:        | 3"  |
| D) | Space between numbers: | 6"  |

**6.64 LETTERING AND SIGNING-EXTERIOR**

All exterior markings shall be manufactured from 3M 'Scotchlite' 580 series material, red over white paint and white over red. All exterior decals, lettering, logos, and numbers shall be edge sealed.

**6.65 LOGOS**

Two (2) "Metropolitan Transit System" decals approximately six (6") inches tall by ninety-six (96") inches long shall be applied, one (1) to each side of the bus on forward portion of roof panel. The street-side decal shall be located on side of roof panel and shall begin aligned with forward edge of the #1 window frame. The curbside decal shall be located on side of roof panel and shall end aligned with forward edge of the #1 window frame.

**6.66 NUMBERING**

Four (4) sets of four (4) numbers each, six (6") inches high shall be affixed to the exterior of the bus, one (1) set to each of four (4) locations as follows: On front of bus at top front curbside corner, over front door, over driver's window, and on rear of bus at upper street-side corner. Actual vehicle numbers to be provided at pre-production meeting.

**6.67 DISABLED SIGN**

Three (3) international symbols indicating wheelchair accessibility will be applied, one (1) to the front, one (1) to the curbside and one (1) to the rear.

**6.68 DECAL – FRONT**

One (1) "MTS" Logo decal approximately fourteen (14") inches tall by twenty-six (26") inches long and pre-marked shall be applied to the front of the bus below and centered on the windshield.

**6.69 DECAL – REAR**

One (1) Metropolitan Transit System decal with MTS Logo approximately twenty-two (22") inches tall by seventy-two (72") inches long and pre-marked shall be applied to the rear of the bus on engine door.

**6.70 KNEELING AND LIFT DESIGNATION**

The word "Kneeling" with an arrow pointed down, and "Lift" shall be applied just rear of the front entrance door. If bus design utilizes rear axle kneeling, the word "Kneeling" with an arrow pointed down shall also be applied just rear of exit door. Lettering shall be one (1") inch tall. Exact location will be specified by MTS.

**6.71 CALIFORNIA NUMBER DESIGNATION**

California Operator Identification numbers shall be applied to both sides toward the rear of the bus. Lettering shall be approximately two (2") inches tall by fourteen (14") inches long. Location shall be on lower skirt aft of rear axle. Actual number is operator distinctive and shall be furnished at pre-production meeting.

**6.72 BATTERY DISCONNECT DECAL**

Decal shall be on exterior of battery access door and shall read "BATTERY DISCONNECT."

**6.73 AIR TANK DRAIN DECAL**

Decals indicating the location of all air tank drain valves shall be provided.

**6.74 INTERIOR PAINT**

The painted surfaces of the ceiling above the driver's compartment shall be painted with black acrylic enamel, matt finish and applied over a cleaned, primed surface.

The lower dash, inside of entrance and exit doors, windshield frame area, and instrument case shall be painted with semi-gloss black acrylic enamel applied over a cleaned and primed surface.

**6.75 LETTERING AND SIGNING - INTERIOR**

Markings shall be "Scotchcal" only, elastomeric, pigmented film, die-cut, and pre-spaced, with pressure-sensitive adhesive. All marking materials shall be applied in strict conformance with the film manufacturer's recommendations as to surface preparation and application procedure. No hand lettering or stenciling will be permitted.

Decals are to be furnished and installed by manufacturer and must be in English and Spanish.

**6.76 VEHICLE NUMBER**

One (1) each, four (4) digit set of six (6") inch numbers on destination sign door.

**6.77 NO SMOKING**

No Smoking - No eating - No Radio Playing on destination sign door.

**6.78 WHEELCHAIR RAMP OPERATING INSTRUCTIONS**

Wheelchair Ramp Operating Instructions shall be provided in driver's area pertaining to dash control buttons and switches. Wheelchair Ramp Operating Instructions shall also be provided in the manual control operation compartment if bus is equipped with manual controls.

**6.79 PRIORITY SEATING SIGNS**

Contractor shall provide and install sign(s) which indicate that seats in the front of the vehicle are priority seats for persons with disabilities, and that other passengers should make such seats available to those who wish to use them. At least one (1) set of forward-facing seats shall be so designated.

Each wheelchair or mobility aid securement location shall have a sign designating it as such.

Characters on signs required by this section 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 5/8" inch, 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 light-on-dark or dark-on-light.

**6.80 INTERNATIONAL SYMBOL**

One (1) International Wheelchair Lift symbol immediately below the bottom of the window adjacent to each wheelchair tie down location.

**6.81 REAR DOOR OPERATION**

Passenger rear door operating instructions shall be in English and Spanish to read as follows: (Caution! Stand clear door controlled by driver). Spanish to read as (Cuidado! mantenga distancia la puerta esta controlada por el conductor).

**6.82 VANDALISM/NO SMOKING**

Two (2) Vandalism is a Crime and No Smoking signs over rear wheel housings and in the standee windows on both the curbside and roadside.

**6.83 NO RADIOS/NO EATING**

Two (2) international symbols, No Smoking/No Radios/No Eating signs over rear longitudinal passenger seats (curbside and roadside).

**6.84 EMERGENCY ESCAPE HATCH INSTRUCTION**

Emergency escape hatch identification and operating instructions to be provided in Spanish and English.

**6.85 RADIATOR FILL CAUTION**

Radiator fill door "caution" on inside of door shall be provided.

**6.86 EMERGENCY EXIT INSTRUCTIONS**

Emergency Exit and Window Release Lever operations instructions - MUST BE METAL and riveted to window frame rail within six (6") inches and adjacent to each release lever.

**6.87 WATCH YOUR STEP SIGN (PISE CON CUIDADO)**

"Watch Your Step" signs shall be installed at entrance door area, at exit door area, and at the steps to the rear deck area. The exact locations will be specified by MTS.

All bilingual signs are to be pre-approved before installation.

**CHASSIS SPECIFICATIONS****6.88 CHASSIS SPECIFICATIONS**

This section, broadly titled "Chassis" details the requirements for primary and secondary (accessory) mechanical equipment of the transit bus.

**6.89 ENGINE**

The engine shall be an electronically controlled Cummins ISL-G 8.9 Liter CNG Engine with 280 bhp and 900 lb.-ft. of torque. The engine shall meet or exceed all EPA and/or any other emissions requirements for engines in force at the time of manufacture when operating on fuel equal to CARB Specifications for Compressed Natural Gas #2292.5.

The engine and transmission shall be designed to mount into the bus aligned in a "T" Drive configuration.

Specifications for engine electronic controls shall include a full-load idle speed of 600 RPM, a fast-idle speed of 1000 RPM, and a maximum engine speed governed at 2200 RPM. The engine shall incorporate electronic controls capable of transmitting and receiving electronic inputs and data from other drive train components and broadcasting that data to other vehicle systems. Communication between electronic drive train components and other vehicle systems shall communicate data using a combination of SAE Communication Protocols J1939 and/or J1708/J1587. Electronic controls shall be compatible with either 12 or 24 volt power distribution and compensate for changing conditions such as variations in vehicle weight and engine power. The electronically controlled engine shall have on-board diagnostic capabilities, be able to monitor functions, store and time stamp out-of-parameter conditions in memory, and communicate faults and vital conditions to service personnel. The engine shall contain built-in protection software to guard against severe damage. A diagnostic reader device and/or laptop computer connector port, suitably protected against dirt and moisture, shall be provided in the operator's area. The on-board diagnostic system shall trigger a visual alarm to the operator when the electronic control unit detects a malfunction.