



**Ahmedabad Janmarg Ltd
(AJL)**

**REQUEST FOR PROPOSAL (RFP) FOR SELECTION OF BUS OPERATOR FOR
PROCUREMENT, OPERATION AND MAINTENANCE OF MIDI AC FULLY BUILT PURE
ELECTRIC BUSES ON GROSS COST CONTRACT BASIS**

**Specifications of Fully Built Pure Electric Air conditioned (AC) Midi BRTS Buses,
9200±200 mm long, 900 mm Floor Height**

January, 2018

Volume 3: Midi Bus Specifications

Part I – General requirements

1. Introduction and Scope:

End-use requirement oriented specifications, with maximum make / model neutrality, for fully built Electrically propelled air-conditioned (AC) Midi buses for Bus Rapid Transit System (BRTS) operations are brought out here. Manufacturer/Bodybuilder/Operator of buses would furnish technical details for assemblies / sub-assemblies/ systems/ equipments as per Technical Specification of this Section in appropriate formats.

The specifications cover end use based design, evaluation, fabrication & testing features of AC Midi bus for Ahmedabad BRTS operations for transportation of passengers mainly in Ahmedabad municipal areas. The bus design should be energy efficient, environment friendly, safe, efficient and reliable besides meeting all statutory, legal and other requirements, as also those related to easy passenger accessibility including for persons with disabilities (PwDs), passenger comfort, driver's work place, internal and external aesthetics, ease of repair and maintenance etc.

Offered bus Specifications would comply with all applicable Central, State and local laws (including Acts, Rules & Regulations). These would include, but not be limited to, the provisions of Disability Act 1995 as amended till date as well as state and local accessibility, safety, noise and other requirements. The bus would meet or exceed the Central Motor Vehicles Rules (CMVR) of India / Safety Norms, noise & other norms applicable at the time of supply. In the event of any conflict between requirements emanating from these specification and those as per any statutory/legal, etc in force, the superior/ higher requirements/Standards would prevail.

The word "Bus" wherever used in the specification means the "9200±200 mm long Electrically (Battery powered) propelled (Electric Propulsion System or EPS) or Pure electric air-conditioned Midi bus with 900 mm ± 10 mm floor height as per specifications given in this document. The urban bus would have right hand drive.

For BRTS operations, a fully built bus as per specs detailed in this document and those of UBS II is envisaged.

2. General Design Features of the bus:

- 2.1. Bus would generally be designed and manufactured in accordance with the UBS II specifications & 'Code of Practice for Bus Body Design and Approval' (AIS 052 includes amendments applicable to CNG buses)-- hereinafter referred to as Bus Code-; as applicable to buses in India/CMVR rules/Gujarat motor vehicle rules whichever is superior. Details of relevant standard followed would be indicated against each item.
- 2.2. Bus body design would consider all other aspects / provisions to be made on proposed bus body facilitating ease of its mounting /erection on the acquired chassis without causing any damage / defect to chassis / its aggregates etc and further facilitating ease of repair and maintenance of all other fitments / aggregates provided on bus chassis, etc.
- 2.3. Bus would be designed to carry commuters in the urban/municipal areas mainly in the corridors of BRTS, Ahmedabad, with ease of boarding and alighting especially for ladies, senior citizens and Persons with Disabilities (PwDs). Buses would be provided with wheel chaired disabled persons friendly access and anchorage system.

- 2.4. Bus design would be suitable for daily operation of 16 to 20 hours in AJL with peak loading of about 42 passengers (each passenger weighing 68 Kgs on an average and carrying a load of 7kgs each), average journey speed of about 25Kms per hour with frequent starts/stops, say, after every 500 to 1000 mtrs. The max attainable speed of the bus would be in range of 75(70 ± 5) kmph without Speed Limiter and maximum 50 KMPH with speed limiter. Speed Limiter for the above limit is mandatory for BRTS operations as per direction Hon'ble High Court of Gujarat.
- 2.5. Bus design would be eco-friendly, energy efficient, safe, and comfortable meeting specified standards / norms (as amended up to date of supply).
- 2.6. Bus must be of proven design suitably modified to climatic & operational conditions, infrastructure and road conditions as obtaining in urban/municipal areas of Ahmedabad.
- 2.7. Bus design should meet all statutory requirements applicable for the city of Ahmedabad in all respects.
- 2.8. The bus structure would meet requirements of structural strength, stability, deflection, vibration, crashworthiness, roll over protection etc. amongst others for at least the following main loads including those as per annexure 3 of UBS II:
- i. Static loads
 - ii. Dynamic loads
 - iii. Single wheel bump loads
 - iv. Double wheel bump (diagonally opposite) loads
 - v. Braking and acceleration loads
 - vi. Front impact loads
 - vii. Roll over loads
 - viii. Speed breaker induced loads
- 2.9. Bus/ bus-body design would be a proved design duly evaluated by agencies authorized as per CMVR using Finite Element Analysis for above loads/performance requirements for values for above loads/ conditions /performance parameters as given in subsequent paragraphs.
- 2.10. Minimum required performance values/ data for above load conditions may be considered as follows:
- i. Strength (Factor of safety): minimum of 1.35 (tolerance – minus 10%) i.e. design stress would be $\leq 1/1.35^{\text{th}}$ of yield stress.
 - ii. Stiffness (Deflection): 5mm.
 - iii. Vibrations (Lowest Natural Frequency):5Hz
 - iv. Frontal Impact:
(Velocity = 56 Kmph against fixed rigid barrier)
 - Head Injury Criterion(HIC) = 1000
 - Crumbled Zone = 132mm
 - No part of structure would intrude into residual space.
 - (HIC= Head Injury Criterion calculation is based on acceleration level at the head of driver/ passenger & time duration during which maximum value of above acceleration is build up. Typical acceleration at the head should not exceed 80g continuously for 3 milli seconds to avoid head cracks).
 - v. Roll over (as per bus code – AIS 052) tests with modifications of making the bus roll from ground level instead of the raised platform:
 - Bus tilted to its unstable position
 - Bus allowed to fall freely under gravity from this position.
 - Gross vehicle weight of the bus is to be considered

- The Energy absorbed by the structure = 0.75 E_R
{ E_R = Reference energy.-- the Potential energy of the bus in its (unstable) equilibrium position}.

$E_R = M.g.h$, Where M= Effective weight of the bus; g = Acceleration due to gravity; h= Height of C.G. above ground level in (unstable) equilibrium position.}

-Angular velocity should not exceed 5 deg/sec.

-The unstable position should not occur before 35 deg.

-No part of structure intrudes into residual space.)

vi. Buckling Factor would be equal to or more than four.

vii. Various loads:

- Normal Loads (Static) = No. of Passengers x wt. of passengers (68 Kgs.) + passenger luggage weight (7 Kgs). (Besides the vehicle related loads).

- Bump Loads:

- Bump height = As per relevant BIS/Indian Road Congress Guidelines.
- Case I: Single Wheel on Bump/Pot hole.
- Case II: Diagonally opposite wheels on Bump/Pot hole.
- Case III: Both wheels (Front & Rear) on Bump/Pot hole.

- Braking Loads: 0.6g

Horizontal = 0.6g load, Vertical = 1g load, (Applied together)

2.11. The bus, loaded to Gross Vehicle Weight (GVW), with crush load and under static conditions, would not exhibit deflection or deformation that impairs the operation of steering mechanism, doors, windows, passenger escape mechanisms and service doors, etc.

2.12. Manufacturer's certificate supported by testing and type approval agency's certificates along with the bus as also technical specifications/drawings required for inspection, performance assessment as above to be supplied along with the bus. Besides meeting the statutory requirements the bus would be designed with respect to its body and different aggregates/systems /sub systems to operate satisfactorily in urban transport service for at least 10 years or 8,00,000 Kms whichever is later.

2.13. Detailed schematic drawings of bus structure, seats, interior/ exterior fittings, electrical systems, wiring looms / harness, photometric items and other accessories along with complete details of materials used, their specification, manufacturing tolerances etc. would be provided by the bus manufacturer/ Bodybuilder. Additionally, details / drawings of mounting / fastening bus body to chassis to be provided along with the bid specifically bringing out whether bus body would be welded and integrated to chassis or fastened using fasteners along with applicable mechanism system /arrangement. Detailed Circuit diagrams for electrical be also provided by the bidder/bus manufacturer. Electric wiring in the bus (other than EPS) would be of multiplexing type. Additional details of wiring for electric propulsion system, inter-alia indicating location of battery packs, traction controller, cooling system, safety mechanisms, etc with appropriate colour code etc would be supplied with the bid.

- 2.14. Details of general appearance, seating layout and structural of roof, floor, sides, front & rear show and driver's cab, etc. would be supplied. Main dimensions of the fully built bus i.e., overall length, overall width, overall height, saloon height, pillar to pillar distance, seat pitch, number of seats (excluding seat for the driver), entry/exit gates, wheel chair locations/fastening arrangement and the accessibility mechanism, etc., mounting arrangement for battery packs, drive motor/s, traction controller, etc would be supplied along with the schematic diagrams/printed literature of the bus.
- 2.15. Material used in construction of buses would be as per Bureau of Indian Standards (BIS)/ Automotive Industry Standards (AIS)/ specifications and/or other international specifications meeting/ surpassing performance & other requirements as given in the Bus Code. In absence of above specifications, Association of State Road Transport Undertakings (ASRTU) specifications could be followed. Wherever Indian Standards are not available, internationally acceptable Standards may be referred. Specifications/ Standards followed would conform to Specification/Standards as amended /up dated/ or the latest published by the concerned agencies. Wherever no specifications of any item have been notified as International/ National Standards etc. actual specifications of that item used be mentioned. Guaranteed life of the bus and its other aggregates be indicated item by item. Periodical maintenance schedule for obtaining the said life of the bus be also indicated.
- 2.16. BIS Standards are normally available from Bureau of Indian Standards, Manank Bhawan, 9-Bahadur Shah Zafar Marg, New Delhi-110 002. Web site: <http://www.bis.org.in>. Similarly, AIS Standards are available from Automotive Research Association of India, Post Box No.832, Pune-411 004. Web site: <http://www.araiindia.com>. ASRTU Specifications are available from Association of State Road Transport Undertakings, Sector 12,Dwarka, NewDelhi. Web site: <http://www.asrtu.org>.
- 2.17. Suitable traps/openings with appropriate sealing and covers would be provided for repair and maintenance of various aggregate/systems/sub systems / chassis / body/ their components, etc of the bus.
- 2.18. Any restriction in design, manufacture and mounting of bus body on chassis, as provided by chassis manufacture, as a part of detailed instructions for this purpose, be meticulously followed while mounting / joining / integrating bus body to bus chassis.
- 2.19. The bus would be so designed as to maintain operational stability requirement as per Bus Code. Interior noise and pass by noise of the vehicle would conform to BIS: 12832:1989 or latest and BIS: 3028:1998, 10399: 1998 or latest respectively.
- 2.20. It would be ensured that the design, manufacture, certification(wherever called for) & installation of major bus sub-components and systems are compliant with all such sub-component vendors' requirements & recommendations within the frame work of any statutory, legal and or any other lawful/functional requirements. A certificate of compliance would be shown on demand. Components used in the vehicle would be of heavy-duty design.
- 2.21. Any other provisions/fitments required for safe and efficient operation and or for fulfilling statutory requirements be provided in the offered bus.

3. Electric Propulsion system:

- 3.1. Electric propulsion system /Pure Electric Power Train would have adequate power/rating to obtain desired performance in respect of its adequacy of power, bus acceleration levels, specific power consumption, energy density, etc. Electric propulsion system to have adequate power not only to propel the bus at its GVW but also to operate efficiently all other auxiliary devices, and the air conditioning systems fitted to bus, simultaneously, etc. As the bus is required for operation in urban services, characterised by frequent stops and starts, electric propulsion system of adequate power for efficiently negotiating such frequent stops and starts and urban area gradients, achieve bus acceleration etc at full load, be considered for use. The power/battery rating, control mechanism, etc for obtaining above performance levels be indicated by the bidder in his bid along with other details called for in the annexure
- 3.2. **Performance data / curves / charge - discharge cycle curves and other details of the electric propulsion system have to be supplied. A detailed set of calculations indicating adequacy of said electric propulsion system for proposed urban bus be provided along with all performance parameters of selected electric propulsion system.**
- 3.3. The electric propulsion system and its accessories would be easily replaceable. Electric propulsion system mounting would be such as to minimize transmission of vibrations, if any, besides sustaining its loading impact to bus structure. Electric propulsion system mounting, structural design & foundation etc would be so designed / positioned as to facilitate easy accessibility & replacement. Electric propulsion system design would be such that it would not be overheated during normal operating conditions of vehicle. An arrangement for audio-visual signal would be provided in the event of electric propulsion system and or any of its subsystems getting **overheated excessively. The temperature at which signal operates would be indicated. Similar arrangement for other sub-system of electric propulsion system with their monitorable indicators be made on dashboard. The electric propulsion system would be equipped with electronic controller / management and on-board diagnostic system.**
- 3.4. Electric propulsion system compartment/s would be insulated to avoid transmission of heat and noise to saloon area. This firewall would preclude or retard propagation of an electric propulsion system compartment fire into passenger compartment. Only necessary openings would be allowed in the firewall, and these would be fireproofed. Wiring may pass through only if connectors or other means are provided to prevent or retard fire propagation through the firewall. Electric propulsion system access panels in the firewall would be fabricated of fireproof material and secured with fireproof fasteners. These panels, their fasteners, and the firewall would be constructed and reinforced to minimize warping of panels during a fire that will compromise integrity of the firewall. Bus manufacturer would provide relevant details to AJL.
- 3.5. The electric propulsion system would be suitably designed to operate optimally under Ahmadabad's peak summer heat and dust.
- 3.6. Electric propulsion system noise and chemical, electro-magnetic emission levels, if any, must conform to the national / international and or any other Indian Standards, adopting the most superior one.
- 3.7. Specific power consumption of electric propulsion system in terms of kms per KW hour at Standard operating conditions (Indian urban operating cycle) would be indicated along with guaranteed energy consumption level (kilometres per kilowatt hour i.e. km per kwh) under GVW and the standard urban operational conditions / cycle.

- 3.8. For sound-proofing & for protection against fire risk in electric propulsion system compartment/s, no flammable material or material liable to soak chemical fumes, or any combustible material would be used in electric propulsion system compartment/s unless the material is clad by an impermeable fireproof sheet. A partition of heat-resistant material would be fitted between the electric propulsion system compartment/s & any other source of heat.
- 3.9. The vehicles would have high voltage / high current lines designed /protected / laid out in a manner as to provide adequate safeguards against any and all operational problems and safety hazards arising out of / caused by these items.
- 3.10. Details of make / model etc of various items of electric propulsion system and its subsystems would be provided as part of bid.

4. Battery Cooling system:

- 4.1. Cooling system would efficiently dissipate heat from the electric propulsion system and its subsystems. Replacement/ maintenance of battery cooling system and its items be also easily carried out. Details of battery cooling system specifications, cooling capacity, cooling medium, repair and maintenance procedures etc would be supplied.

5. Traction Controller System:

- 5.1. An efficient traction controller and or any other appropriate mechanism / device to efficiently regulate speed-power relationship for the electric propulsion system be provided for facilitating smooth, effective and jerk free drive of the bus. All operational controls/buttons/switches etc be conveniently located within easy reach of the driver. The **traction** Controller System and the controls/operational sub systems be easily accessible for repairs and also be easily replaceable. Complete system details need to be supplied with the bus.
- 5.2. **Traction** Controller System be fitted with a mechanism which makes it possible to operate reversing mechanism only when vehicle is stationary.
- 5.3. Details of make / model etc. of various items of **traction** Controller System would be provided as part of bid.

6. Suspension:

- 6.1. The bus would be fitted with waveler suspension system at front and air-suspension at rear axles. The suspension system would be fitted with shock absorbers, suitable for trouble free operation and jerk free comfortable ride in existing road conditions of Ahmedabad municipal area.

7. Steering System:

- 7.1. Hydraulic re-circulating ball type power steering would be provided.

8. Braking system:

- 8.1. The braking system would be full pneumatic type with fail-safe dual circuit having four-way protection valve, auto slack adjuster, disc type brakes in front and drum type at rear, with non-asbestos brake lining having temperature and wear characteristics suitable for harsh urban operations. Brake squeal would be absent under normal conditions of operation. An air compressor/dryer which minimizes oil carry over would be fitted. Braking system would be fitted with air dryer and oil/ water separator system. Buses

would also be provided with hand operated pneumatic flick valve type parking brakes at rear wheels. Air pressure line would be treated for corrosion resistance.

- 8.2. In the event of failure of EPS and or loss of air in system, adequate provision be made for obtaining effectiveness of service brake system and or for deactivating the spring actuated brakes.
- 8.3. Regenerative Braking system of appropriate design / specification be provided

9. Wheels and tyres:

- 9.1. The bus would be fitted with steel radial tubeless tyres of optimal size and design conforming to AIS-044 Part I with wheel rims of corresponding size conforming to AIS/ BIS: 10694 (part 3)-1991 or latest. The bus would be supplied with 7 sets of tyres (two on front and four on rear wheels) fitted on the bus plus one set as spare Stepney.
- 9.2. Details of type, specifications, capacity, make, model etc. of tyres/wheel rims would be provided as part of the bid.
- 9.3. Suitable guards be provided near wheels to prevent damage/ for obtaining safety from stones hurled from tyres.
- 9.4. Splash aprons of minimum 6.50mm thickness composed of rubberized fabric would be installed behind the wheels as needed to reduce road splash and protect under floor components. Splash aprons would extend downward to within 100mm of road surface at static conditions. Apron widths would be no less than tyre widths, except for the front apron, which may extend across the width of the bus. Splash aprons would be bolted to the bus under structure. Splash aprons and their attachments would be inherently weaker than the structure to which they are attached. The flexible portions of splash aprons would not be included in road clearance measurements. Other splash aprons would be installed where necessary to protect bus equipment.

10. Axles:

- 10.1. Solid beam front axle & grease type front bearings & seals of reliable & proven design of adequate capacity to take care of maximum Gross Vehicle Weight (GVW) & crush loading expected during life span of the bus of minimum 10 years or 8, 00,000 Kms. whichever is later
- 10.2. The bus would be driven by a single heavy-duty rear axle of proven design, adequate capacity to take care of maximum GVW & crush loading expected during life span of bus of minimum 10 years or 8, 00,000 Kms. whichever is later. Transfer of gear noise to bus interior would be minimized. Lubricant drain plug would be magnetic type, external hex head. If a planetary gear design is employed, oil level in the planetary gears would be easily checked through plug or sight gauge.
- 10.3. The drive shaft, if any, would be guarded to prevent it striking floor of the bus or the ground in the event of a tube or universal joint failure.
- 10.4. Details of type, specifications, capacity, make, model etc. of Front& Rear Axles would be provided at in the bid.

11. Battery Packs :

- 11.1. Electrically propelled vehicles must meet and satisfy all requirements of “code of practice for Electric Propulsion system vehicles”, safety and other requirements as per AIS 052, safety and type approval as per AIS 024 and 028, and as per any other applicable standard and procedures; regulatory requirements as per CMVR / GMVR and any other applicable regulations for operation in the State of Gujarat.
- 11.2. Battery packs of requisite capacity would be appropriately mounted on to the bus keeping in mind convenience of battery maintenance /charging / replacement etc, safety of system and its maintainability, operation in the BRTS corridor and or outside the corridor.
- 11.3. Capacity of the battery packs would be adequate for over 230 kms of bus running without refilling.
- 11.4. Battery packs and other components of Electrically propelled vehicles should conform to applicable AIS / BIS standards or International Specs / standards in absence of AIS /BIS specs. Battery packs and other components / units of Electric Propulsion system be tested and certified to conform to said standards not more than six months prior to fitment on buses. Detailed drawing indicating location and mounting details of Battery packs /and other sub-systems of Electric Propulsion system be provided along with the bid
- 11.5. Make, model, capacity, etc of each Battery packs and the number of such Battery packs fitted, be submitted along with the bid. Similar details be also submitted for traction controller and other subsystems of the Electric Propulsion system.
- 11.6. All requirements of AIS / BIS / CMVR/GMVR etc for Battery packs, Electric Propulsion system / sub-systems and components, etc be fully met and test certificate for the same be provided.

12. Under frame & Structure:

- 12.1. The under frame and super structure would be suitably designed to carry dense crush load of over 42 passengers (assuming an average weight of 68 kg per passenger and hand luggage of 7kgs each) consisting of seated and standee passengers, the superstructure of steel tubing, bus tare weight, all other fitments such as AC system, etc and meet performance requirements under various loads indicated earlier. The structure would be designed to withstand the transit service conditions of operation throughout its service life.
- 12.2. Bus would be of integral construction / fastened to chassis frame depending upon the chassis design, with the super structure fabricated using steel tubing (ERW– Rectangular / Square Sections) conforming to BIS 4923-1985 or latest, of grade Yst – 240.
- 12.3. A comprehensive multi-stage anti-rust treatment would be provided to bus flooring, sides, roof, under-structure, axle suspension components etc. for resistance to corrosion or deterioration from atmospheric conditions & road salts so as to enable them & the bus frame to last for at least 10 years or 8,00,000Kms whichever is later.
- 12.4. Samples of all materials & connections would withstand a two weeks (336 hours) Salt Spray test in accordance with ASTM procedure B117 with no structural detrimental

effect to normally visible surfaces & no weight loss of over 1%. Details of treatment provided with relevant specification details be indicated along with suitable calculations to reflect that the corrosion prevention treatment meets the requirements of minimum 10 years life in Ahmedabad's operational environment. Details of the system followed for corrosion prevention of internal surfaces of structural tubing would be supplied. A certificate of testing from an authorised test lab be provided.

- 12.5. Front and rear structure design would be energy absorption type to reduce impact stresses into under frame/side structures/ other areas of the vehicle. Damaged area of the vehicle would be easily repairable and or replaceable in the event of any major damage at normally available workshop facilities and without any need for specialised tools / fixtures and equipments.
- 12.6. Entire surface of bus under floor and sides exposed to ground would be covered with appropriate corrosion prevention & flame retardant paint coating for protection against harmful effects of water, mud etc and to retard flames, if any. Wheel housings would be constructed to contain tyre bursts during operation and be flame retardant in case of tyre fire.
- 12.7. Sufficient clearance & air circulation would be provided around the tyres, wheels & brakes to preclude over-heating when the bus is operating
- 12.8. MIG welding would be used for steel structural member's fabrication.
- 12.9. All structural members would be MIG welded besides suitable gussets/ brackets of adequate size & thickness be provided on floor, side, front, rear & roof structure to ensure structure rigidity & integrity. Material, shape size and specs of such gussets / brackets would be provided by the bus supplier in their supplied drawings.
- 12.10. After anti corrosive treatment, structural members would be coated with red oxide/ Zinc Chromate primer & superior quality black paint.
- 12.11. During structural assembly operations, a number of holes are drilled and or weldments made after the corrosion prevention treatment of components/structural items/members causing loss of such treatment and exposing these items to corrosion. Manufacturer would take sufficient care to carry out corrosion prevention of items so exposed to effectively prevent corrosion.
- 12.12. Under floor to sidewalls would be sealed to prevent dust ingress.

13. Panelling:

- 13.1. Bus exterior side panels would be fitted with stretched steel sheet at waist level. The exterior front-end panelling would be of steel sheet while roof, rear, sides & skirt panelling would be of aluminium. All interior panelling would be of Acrylonitrile Butadiene Styrene (ABS) conforming to relevant National or International Standards.
- 13.2. Wherever aluminium is joined with steel or with/ any dissimilar metals together, the involved joints would be treated with thick layer of approved quality dielectric paint conforming to relevant Indian/ International Standards, before assembly. Adequate treatment be also provided to avoid any incidence of galvanic corrosion between dissimilar metals.

- 13.3. Panels would not have any waviness & would be so mounted as to present smart aesthetic exteriors. Details of the above said panelling including specifications / thickness/ sizes of panels, fittings, rivet/ bolt pitch etc would be supplied.
- 13.4. All side skirt panels below stretch panel be of such design as would facilitate quick replacement of any damaged panel(s) with pre-painted panels. The side skirt would be able to withstand side impact as per provisions of BIS: 14682-1999 or latest. Similarly rear end would be able to withstand rear impact as per the provisions of BIS: 14812-2000 or latest
- 13.5. Anti-drumming compound would be applied on inner side (enclosed surfaces) of entire panelling.
- 13.6. Roof structure would be thermally insulated with flame retardant Polyurethane or glass wool of minimum 40 kgs/m³ density. The specifications/ BIS Standards for aforesaid insulating material would be supplied. Insulation would also be provided at other locations for improved performance of air conditioning system.
- 13.7. MIG welding for fabrication of aluminium components would be used.
- 13.8. Rain gutters would be provided to prevent water flowing from the roof onto the passenger doors, driver's side window, and exterior mirrors. When the bus is decelerated, gutters would not drain onto windshield, or driver's side window, or into the door boarding area. Cross sections of the gutters would be adequate for proper operation.
- 13.9. Entire front end of the bus would be sealed to prevent debris accumulation behind the dashboard and to prevent driver's feet from kicking or fouling wiring and other equipments. Front end would be free of protrusions that are hazardous to passengers standing or walking in front of the bus during rapid acceleration.
- 13.10. Interior panels would be attached so that there are no exposed unfinished or rough edges or rough surfaces. Panels & fasteners would not be easily removable by passengers.

14. Paints:

- 14.1. All structural members of the bus would be treated for corrosion prevention internally as well as externally and painted wherever required. Polyurethane (PU) painting base spray paint of standard companies like Sherwin williams, reberlo or debeeror or equivalent conforming latest/ international Standards as applicable would be used for exteriors painting of bus including interiors wherever required. Colour shade would match to the shades as per BIS: 5-1978 or latest. Details of paints used, surface treatment & preparation, corrosion prevention treatment, base primer coatings, number of paint coats to be applied etc would be supplied.
- 14.2. All exterior surfaces would be smooth & free of wrinkles & dents. Exterior surface to be painted would be properly prepared as required by paint system supplier, prior to application of paint to ensure a proper bond between the basic surface and succession coat of original paint for stipulated service life of the bus. Paint would be applied smoothly and evenly with the finished surface free of dirt and following other imperfections:
 - i. Blisters or bubbles appearing in the topcoat film.

- ii. Chips, scratches, or gouges of the surface finish.
- iii. Cracks in the paint film.
- iv. Craters where paint failed to cover due to surface contamination.
- v. Overspray.
- vi. Peeling.
- vii. Runs or sags from excessive flow and failure to adhere uniformly to the surface.
- viii. Chemical stains and water spots.

15. Colour schemes:

- 15.1. Exterior, interior colour schemes and logo/ graphics would be painted as directed by AJL/AMC. Information, on seats, for reservation for persons with disabilities, ladies, senior citizens would be marked as per the details provided by the AJL .

16. Service doors:

- 16.1. Two service doors (passenger entrance / exit) with steps, separated with an interspacing partition of 500 mm width (from the central line of the nearside) would be provided as indicated in summarised specs in part II, would be provided on near side (on kerb side wall) – both the gate apertures would be between front and rear axles of bus. Minimum one service door or Maximum two service doors with steps would be required to be provided with specifications as indicated in the summarized specs in part II on the near side (on the kerb side wall).
- 16.2. The Selected Bus Operator/ Chassis manufacturers /Bus Body builder will be required to provide options with regards to position of the such door(s) on the near side. While the intention is to provide doors as per provision already stated, the Authority will finalize the positions of the kerbside door(s) in consultation with the Selected Bus Operator/ Chassis manufacturers /Bus Body builder after assessment of all the options. Cost of any modifications that may be part of the final solution agreed will be to the bidders account.
- 16.3. The partition between Kerb side doors and other features of the door would be provided as forming part of the approved solution.
- 16.4. Two service doors (without steps) separated with an interspacing partition of 400 mm width would be provided on off-side (driver side wall) for level boarding / alighting of passengers at BRTS stations. Layout of passenger service gates on near side and on off-side is given at Appendix 'A' to part II.
- 16.5. Doors would be jack-knife type.
- 16.6. Operation of entrance and exit doors would be electro-pneumatically controlled by driver with internal and external emergency operational controls. In an event of an emergency, it would be possible to open doors manually from inside the bus by using a force no more than about 10 Kg. after actuating and unlocking device at each door. Unlocking devices would be clearly marked as an emergency device & would require two distinct actions to actuate.
- 16.7. Doors, operating mechanisms, door hinges and locks would comply with safety requirements as per Indian/ International Standards (to be specified and supplied by the bus manufacturer). Overall dimensions and construction of entrance and exit doors would be identical so that doors and door operating mechanisms are interchangeable. Closing and opening time of doors should be in the range of 4 seconds each. There

would be maximum opening area in longitudinal & vertical directions in fully open condition. Door operating mechanisms, brackets etc would be maintenance free and designed with lifetime durability of minimum 10 years or 8,00,000 Kms. whichever is later.

- 16.8. A pilot lamp on the driver's dashboard would be provided to warn that the door is 'Open' or not fully closed.
- 16.9. Entrance and Exit doors would be provided with suitable support in form of grab handles for boarding/ alighting passengers on JK door flaps. Electronic / other suitable sensors would be installed at all entrance and exit doors to retract door automatically if any obstruction to door occurs during door closing. It must be effective until door is fully closed.
- 16.10. Colour shade would match to the shades as per BIS: 5-1978 or latest.
- 16.11. A red "Door Closing" sign would be installed above exit doors. The sign will blink when doors are closing.
- 16.12. A suitable device to prevent doors from opening as long as bus is in motion would be provided.
- 16.13. Service Doors' operation would be controlled with help of separate push buttons and one switch for each door mounted over the 400 mm partition between the doors. One red master button to close all entrance and exit doors at same time would also be provided
- 16.14. All button and switches would be labelled on a panel to right side of the driver.
- 16.15. Heavy-duty prominent nosing of bright yellow colour would be used to protect edge at entrance/exit.
- 16.16. Access door would be provided with heavy-duty sealing to avoid ingress of dust into passenger compartment. Upper & lower section of both front & rear doors would be glassed for not less than 45% of the respective door opening area of each section. Glazing material & glass in doors would be same as in side windows.
- 16.17. Details of above service doors including electro-pneumatically controlled door closing system with complete circuit diagram would be supplied Photo-cell controlled opening / closing functions of doors and a "sensitive edge" made for safe entry exit be fitted.
- 16.18. Doors would be fitted with heavy-duty hinges as per bus code.
- 16.19. Doors would be fitted with heavy-duty locks with &/ without lock & key depending upon their use. Striker plate would be fitted at the closing end of locks.
- 16.20. All handles would match to décor of its fitment location or would be chrome plated.
- 16.21. Doors would open or close completely in about 4 seconds from the time of control actuation and would be subject to closing force requirements and adjustment requirements. Front door would remain in commanded state position even if power is removed or lost. Operation of & power to, passenger door would be completely controlled by driver. A control or valve in driver's compartment would shut off power to, and/or dump the power from, front door mechanism to permit manual operation of front door with bus shut down.

17. Guard / Guard rails:

- 17.1. Suitable guard would be provided in areas such as service doors entrance/exit area where seated passengers are likely to be thrown into as a result of heavy braking, Guard height would be minimum 800mm from bus floor, and guard would extend inward from the wall at least 100mm more than the centre line of the seating position of the passengers who are prone to this risk.

18. Windows:

- 18.1. Windows would of large size for panoramic view. They would be in single piece window glasses. Toughened glass wherever used in bus body would be 4.8 mm to 5.3 mm thick aesthetically installed. Size and shape of the glasses would enable even the standees to have maximum outside view without kneeling. General requirements of windows would be as per the provisions of bus code (AIS 052).
- 18.2. Windows would have provision of suitable sealing to avoid ingress of dust and water and would have proper/ efficient drainage system /UBS II.
- 18.3. Details of window design; fitment etc would be supplied by the bidder along with the bid.

19. Window Guardrail:

- 19.1. Not required for AC Buses.

20. Emergency Exit:

- 20.1. Emergency exits would be provided in bus as per the provisions of Bus Code – AIS 052 / CMVR. Possibility of using passenger entry/exit gate on near side for said purpose would be explored by manufacturer and confirmed. Details of Emergency exits including their numbers, locations, sizes, markings etc would be supplied.

21. Escape hatch:

- 21.1. In addition to emergency exits, at least one escape hatch would be provided in roof as per bus code. A number of additional hatches may also be provided for facilitating ventilation I bus in the unlikely event of air-conditioner failure.

22. Steps:

- 22.1. There would be no steps provided at the entrance / exit gates on off-side except on the gates on near side wall.

23. Floor:

- 23.1. Bus floor design would be without internal steps in floor area, as also in service doors on driver side wall. There would be steps in gates located on near side wall, that is, at left-hand side wall of the bus.
- 23.2. Floor height of the bus would be 900±10mm from ground level to synchronise with BRT station platform height for facilitating level entry / exit of passengers.
- 23.3. Internal saloon height would be 1900 mm minimum.
- 23.4. Floor design would allow easy cleaning including that of sweeping & drainage of water.

- 23.5. Floor would be fitted with fire retardant 12mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513(Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000(IS15061:2002)
- 23.6. The said floor would be covered with anti-skid type silicon grain material of minimum 3mm thickness meeting Indian/ International Standards(to be indicated by the bus manufacturer in the bid),ISO 877/76 for colour, IS5509 for fire retardancy. Adequate sealing would be provided in the floor to prevent ingress of dust, gases, water etc. Provision of draining of water if any on bus floor would be made

24. Gangways:

- 24.1. Gangway-from entry/exit gate walls through the entire bus length, would have clear space of minimum 600 mm for passenger movement and would be generally as per the provisions of the Bus Code (AIS 052)/ UBS II and meet statutory requirements.

25. Handrails and Handholds

- 25.1. Handrails and Handholds would be provided as per provision of bus code (AIS 052) / UBS II. The surface of handrails & handholds would be colour contrasting and slip-resistant.
- 25.2. All handrails would be of aluminium tubing of 32 mm dia and 3 mm thick. Depending upon the size of the bay (i.e. between two consecutive roof hand rail brackets), minimum 2 to 4 numbers handholds per bay would be provided so that every standee passenger even during crush load, is able to grab a hand hold.
- 25.3. Hand holds be made of transparent polycarbonates with provision for display of advertisements. Hand holds be appropriately fastened to the hand grab rails so as to prevent their axial sliding and or rotation. Details of the handrails & handholds fitted would be supplied.

26. Stanchions

- 26.1. Vertical stanchions would be so positioned to facilitate access to seats for those standing. Stanchions would be of 40.0 mm dia and 3.15 mm thick aluminium tubing with surface of colour contrasting and slip resistant.
- 26.2. Stanchion pipes and the handrails would be painted in cannery yellow colour while the joining brackets be painted in grey colour generally matching with inner panelling.
- 26.3. A suitable device, such as high visibility bell pushes, for convenience of passengers to request for stopping bus be provided at appropriate locations.

27. Passenger Seats:

- 27.1. Passenger seats would be front facing, comfortable, durable & maintenance free of 'PPLD/LDPE' (Polypropylene Low Density) moulded construction meeting performance requirements of AIS023 and other requirements as per the Bus Code (AIS 052). The 'PPLD/LDPE' moulded seat would be fitted.

- 27.2. Similarly, 'PPLD/LDPE' moulded seat backrest would be appropriately fitted. Suitable integral type seat hand grab rails would be provided one on top of backrest & one at the back of backrest for seated passengers.
- 27.3. Seat pitch would be maintained at 750 mm (minimum) as per AIS 052 for AC buses.
- 27.4. Details of seat design, material, specifications, pitch and other relevant data and the seating layout would be supplied by the manufacturer for approval of AJL.
- 27.5. Details of seating lay out, accommodating maximum number of seats in 2x2 layouts meeting requirements of the bus code would be supplied. Seating capacity would be 29+D including space for one wheelchair with provision for seat belt, wheelchair anchorage etc. Standee capacity of bus worked out as per system given in bus code (AIS 052) / CMVR would be indicated by manufacturer. Seating and standee capacity of bus would be minimum 42(as worked out as per AIS 052)/CMVR.
- 27.6. Construction/ fitting of the seat would be such as to be easily replaceable and repairable.

28. Seat Belts and its anchorages:

- 28.1. Seat belts would be provided for the seats as per the provisions of CMVR & Bus Code (AIS 052). Any seats provided at rear end of bus, seats in centre (facing the gangway) would necessarily be provided with seat belts. Seat belts and its anchorages would conform to the requirements of AIS 005 and AIS 015

29. Driver's work area:

- 29.1. A driver door of not less than 1600 mm height and 650 mm width and with requisite steps would be provided for entry and exit to driver's work area. Proper hand holds and steps would be provided for easy access to driver's cabin. All other requirements of driver's work area would be as per the provisions of Bus Code -AIS 052. Driver's work area would have lighting arrangement to provide general illumination and it would illuminate half of the steering wheel nearest to the driver. Brake Pedal Angle would be determined from a horizontal plane regardless of slope of cab floor. Driver entrance-cum-exit door would be provided as per Bus Code (AIS 052) with a provision of maximum width of sliding window using material like glazing & glass as used in other side window glasses. Driver work area would be equipped with a 24V DC, 200mm diameter fan mounted at proper height on side structure. Colour of fan would match the interior decor of the bus.
- 29.2. Driver's visibility in front of the bus, seated on driver seat, be as per bus code (AIS 052) / CMVR
- 29.3. Driver's seat would meet the requirements of AIS 023.
- 29.4. Driver partition would be provided as per AIS 052.
- 29.5. A barrier of bulkhead between driver and front passenger seat would be provided. The barrier would minimize glare & reflection in windscreen directly in front of barrier from interior light during night time operation.
- 29.6. Dashboard Instrumentation and Control System
 - 29.6.1. Bus would have ergonomically designed moulded type dash board and instrument panels made out of FRP material. Details of materials

used their specifications etc of dashboard and instrument panel would be provided by the manufacturer.

29.6.2. Bus would have dash board with full instrumentation panel containing meters and gauges to indicate important parameters like air pressure, coolant temperature, bus subsystems operating current, propulsion system battery packs charge level, side indicators, head lights, hand brakes engagement, cooling fluid temperature, level etc. In addition warning lights for low electric charge, high cooling system temperature & low coolant level, low pressure and high temperature of any other subsystem, low battery charge level, if any, low air pressure and bus system operating power supply weak would be provided at the driver's dash board. All the dashboard controls and instrumentation system would be as per the bus code.

29.6.3. On board electronic diagnostics system would be provided as per UBS II.

30. Rear-view Mirrors- Interior and Exterior:

30.1. Rear-view mirrors would be provided on both sides of bus to enable driver to have clear side/rear views. One interior rear-view mirror would also be fitted for viewing saloon area by driver. Installation and performance requirements of rear-view mirrors would conform to AIS 001 and AIS 002. Exterior rear-view mirrors would also enable the driver to view object near bumper area.

31. Sun Visor:

31.1. Adjustable sun visors would be provided for windshield & driver's side window. Visors would be shaped to minimize light leakage between visors & windshield. Adjustment of visors would be made easily by hand with positive locking & releasing devices and would not be subject to damage by over-tightening. Sun visor construction & material would be strong enough to resist breakage during adjustment. Visors may be transparent but would not allow a visible light transmittance in excess of 10%. Visors when deployed would be effective in driver's field of view at angles more than 5° above horizontal.

31.2. An electric horn conforming to BIS: 1884-1993 or latest and installation requirements conforming to AIS 014 would be fitted in bus and further conforming to the provisions of CMVR.

32. ITS Device

The ITMS project is being implemented presently by Authority appointed ITMS Service Provider which includes Automated Vehicle Locating System (AVLS), Passenger Information System (PIS), Vehicle Scheduling and Dispatch System, Incident Management System (IMS), Enterprise Management System (EMS), Business Intelligent System (BI) etc for BRTS and City Bus Operation.

The Project is intended to enhance commuter satisfaction by improving reliability, safety and punctuality of bus operations. Authority intends Each Contracted Midi AC Electric Bus shall come fitted with ITS Equipment such as PIS Display boards

and Tracking Device. The detailed Specification of ITS Devices are specified hereunder;

32.1. PIS Destination boards

Specification PIS –On Bus
PIS System
Usability/Functionality/Capability
All drivers related interfaces for PIS must be provided on Information Control Unit ICU
The route programming file to be uploaded on ICU <i>via USB upto 8GB minimum</i>
Route selection function is to be provided on ICU <i>with easy sorting of Routes</i>
All driver related route information to be displayed on ICU
Amber colored, alphanumeric with graphic capability
In-built light sensor with continuously variable brightness control to enable the display intensity to change based on ambient light conditions
Viewing distance
Front, side and rear signs 50 meters minimum, for single line text, in day and night.
Inner 15 meters minimum, for single line text in day and night.
Display Characteristics
Fixed, scrolling and flashing mode (with fixed route number, upto 6 characters, on front, side and rear signs).
Capability to show customized graphics.
Two lines English /one line local language.
Total display height should accommodate two lines in English language and the Individual heights of each line should be adjustable to enable one line to be larger/smaller than the second line. However, during next stop announcement only single line text is required
It should be possible to display, concurrently, different messages on each of the signs (front, rear, side and inner).
It should be able to display special signs like signs for 'PWD enable bus', 'ladies special'.
Capability to show special characters like (, ' " . ! + - * : ?)
Signs should have ability to retain the last message displayed in the memory of the sign even in the event of power failure and without the message being reloaded. from ICU. Test will be performed by disconnecting the ICU from the sign and power to the sign will be switched 'off' and 'on' to see if the Last message is retained and displayed.
Display and voice announcement in English and local languages using Microsoft fonts via window based software package –Window 8.1

The system should have a programming capability as under
Minimum 75 routes UP and DOWN (150 numbers of destinations) on front, side and rear signs.
GPS triggered next stop display on Inner sign with synchronized voice announcement for minimum 75 stops on each route.
The inner sign should be able to display and announce upto three languages, one after the other in sequence. For example make display and announcement in English, then Hindi or gujarati to be followed by local language for benefit of the passengers. Display and announcements should be possible "before arrival" of the bus at the bus stop, "on arrival" of the bus at bus stop and "after departure" of the bus from the bus stop.
In event of GPS failure the above functionality should be possible through manual intervention on ICU.
Display driver and conductor ID once in between the stops on Inner sign
Inner sign should be able to display text and customized graphics and announce upto pre-recorded messages by driver selecting 1~9 on ICU display panel of the controller.
Display customized graphics plus synchronized voice announcement – preferably location based in case of Million plus population cities
Functionality of Display'clock'-GPSbased or 'Default Messages' on Inner sign
Emergency 'stop' request function- by pressing an emergency switch placed anywhere in the bus the inner sign should display 'stop' message and buzzer located near the driver makes the sound alerting the driver to stop the bus.
In case one or more signs get disconnected (malfunction), the rest of the Signs should continue to function regardless (including fresh communication from ICU)
Sign should be able to store 'diagnostic trouble codes' (DTC)', 'parameters identifiers (PID) and data should be retrievable.
To comply with test standards as per Separate List
Dimensions and technical specifications of signs
Display size / Board Size
Front minimum 200x1800 mm –one
Type I: 220x1800 mm min, Type II: 220x1200 mm min, Type III ;220x1200 mm min, Mini Midi :220x800 mm min AIS 052 2.2.15 Destination Board for Public Service Vehicles
Rear and side: minimum 200x900 mm-one each
Type I: 220x900 mm min x2, Type II: 220x900 mm min, Type III ;220x900 mm min, Mini Midi :220x800 mm min AIS 052 2.2.15 Destination Board for Public Service Vehicles
Inner: minimum100x800 mm –one

Pitch
Front- maximum. H 13.4 mm x V14.1 mm
Side and rear maximum. H10.5 mm x V 14.1mm
Inner 8 x 8 mm maximum.
LED and display quality front, side and rear signs
Amber colored LED, dominant wave length 591~595nm
UV resistant, diffused lens 4 mm (minimum)
Wide viewing angle 120° horizontal & 80° Vertical
Ensure enhanced readability with full clarity on scrolls and long life usage by incorporating non multiplexed system (constant current drive circuit) with typical LED Intensity 400~700 mCd at If =20 mA,
LED and display quality inner sign
LED amber dot matrix viewing angle 45° all around, intensity minimum 40 mCd, dominant wave length 591 ~595 nm
Structure
Front ,side and rear signs : light weight structure with toughened glass fixed with UV resistant adhesive in front
Inner sign: light weight structure with poly glass /acrylic/toughened glass.
Conformal coated PCBA and ROHS Compliant
ICU architecture
Usability/Functionality/Capability
The ICU should control complete Public Information System on Bus including Destination Signs, External Amplifier and Speakers.
The Driver has to select a 'Route', from a Pre-loaded Route Data Base and all information will be displayed and or announced automatically based on Bus Location (GPS).
Provide capability to upload firmware on Signs via RS 485.
A 'beep' sound is made when vehicle speed exceeds set speed limit. The limit is configurable through Software and preset at 50 Kmph
Should be possible to check Firmware Version, Route Data base version.
Technical specifications: ICU
Operating Voltage 9~32 Volts
Processor : 32 bit minimum
Operating system: embedded Windows (8.1) /Linux with programming software
Memory : 256 MB minimum

Interface minimum : RS 485, RS 232, USB, GPS Antenna
Conformal coated PCB boards
Route Data upload on Controller from PC via USB port (USB 1.1, USB 2.0, FAT, FAT 32, 8 GB capacity). Devices prone to pilferage e.g. SD Card is not permitted. Buzzer indication when loading is complete
Integrated with External GPS Receiver and Antenna' via RS 232 using Standard NMEA 1083 GPRMC sentence, transmission Protocol to be provided by the Manufacturer under a 'NDA'.
In-built MP3 files storage/playback function and compatibility with external two channel amplifier minimum 10 Watts rms each suitable for 2 ~8 Ohm impedance with input for external microphone
LCD Panel (resolution 64 x 256 minimum), Illuminated with automatic brightness Control and Backlit Keypad with minimum 20 soft keys including alphanumeric.
Mounting in Radio Slot acc ISO 7736
Programming Software (including simulation, Brightness control, scroll speed control, scroll direction, Template configuration, Graphic library, customised graphics)
Amplifier, Speakers and Wire Harness (with water proof connectors)

32.2. PIS Display Test Compliances

Sr. No	Test standards compliance	Specifications	PIS Signs	Station Signs	PIS Controller
1	Performance parametric test	Nine points, tri temperature/tri voltage- 18V, 27V, 32V,-25°C, room temperature, +80°C test. At each test point the system will be powered on and shut down 5 times as per the supplier's designated procedure and thereafter evaluated for malfunction if any	Y	Y	Y
2	Cold	IS 9000 (Part II/Sec 4)-1977 (reaffirmed 2004) at -15°C for 2 hours in 'on' condition	Y	Y	Y
3	Dry heat	IS 9000 (Part III/Sec 5)-1977: at +80°C for 16 hours in 'on' condition.	Y	Y	Y
4	Damp heat	IS 9000 (Part V/Sec 2)1981 at +25°C /+55°C, Humidity 95%, 24 hours for 6 cycles in off condition. Functional test with power in 'on' condition at start of 2nd, 4th and 6th cycle	Y	Y	Y
5	Vibrationstandard	• Frequency 5~55Hz and return	Y	Y	Y

Sr. No	Test standards compliance	Specifications	PIS Signs	Station Signs	PIS Controller
	AIS 012/AIS:062 - 10g	<p>to 5Hz at a linear sweep period of 1 minute/complete sweep cycle and 10g at maximum frequency</p> <ul style="list-style-type: none"> Excursion -1.65 mm peak to peak over the specified frequency range Test duration 60 minutes Direction of vibration –X, Y, Z axis of device as it is mounted on the vehicle. Test to be carried out in 'on' condition as per ARAI 			
6	Dust and water ingress protection	IS /IEC 60947-1:2004 in conjunction with IS/IEC 60529:2001– ‘Signs IP66, Controller IP66	Y	Y	Y
7	Free fall	IS 9000 (Part VII/Sec 4) Free fall at 500 mm ,(applicable ‘controllers’ only)	N	N	Y
8	Fire resistant	Wiring Harness	Y	Y	Y
9	Reverse polarity protection without fuse	The component must fulfill the function- and service life requirements after being subjected to reversed polarity up to 27 V for 2 minutes. ISO 17650-2	Y	Y	Y
10	Over voltage protection	To ensure service life requirements and functionality. The component shall run for 60 minutes at 38V, without effecting the service life or function. ISO 16750-2	Y	Y	Y
11	Insulation resistance	The insulation resistance measured as per ISO 16750-2 with a voltage of 500 V dc shall not be less than 1 Mega ohm. Insulation Resistance Test will be carried out after completion of ‘Damp Heat Test’ and then the Test sample to be kept at room temperature for at least 0.5 hrs.	Y	Y	Y
13	Load dump	123V, 8 Ohms 200ms pulse 5a as per standard ISO 7637-2. After Test DUT should meet at least class B as per ISO 7637-2	N	N	Y

Sr. No	Test standards compliance	Specifications	PIS Signs	Station Signs	PIS Controller
14	Salt spray test	(AIS: 012/ IS10250) 96 hours	Y	Y	Y
15	EMC/EMI	AIS 004 (PART 3)	Y	Y	Y
	EMC/EMI	'e' Certificate	Y	Y	Y
16	Operating parameters	Supply voltage 24 V \pm 25%	Y	Y	Y
17	LED color test – dominant wave length amber	AIS -010 (Part 5), (Rev 1),2010	Y	Y	NA
18	LED chromaticity coordinates	Limit towards green: $y \leq x-0.120$ Limit towards red: $y \geq 0.390$ Limit towards white: $y \geq 0.790-0.670x$ Reference to AIS010, (Part 5), (Rev 1), 2010 In accordance with CIE 127 condition B	Y	Y	NA
19	LED bulb/SMT intensity and viewing angle	In accordance with CIE 127 condition B	Y	Y	NA
20	Slow Increase and decrease (Ramp up/ Down)	Apply a Voltage of 0V to 27V at increasing rate of 0.5V per second for slow Increase of Power Supply. Apply a Voltage of 27V to 0V at decreasing rate of 0.5V per second for slow Increase of Power Supply.	Y	Y	Y
21	Short Circuit Protection	ISO 16750-2	Y	Y	Y
22	Momentary Interruption	ISO 16750-2	Y	Y	Y
23	Ripple	ISO 16750-2	Y	Y	Y
24	Thermal Shock-Controller Only	ISO 16750-4 Clause 5.3.2	N	N	Y
25	ESD Test	Powered <ul style="list-style-type: none"> • Direct Contact $\pm 6 \text{ kV} \pm 8 \text{ kV}$ • Direct Air $\pm 8 \text{ kV} \pm 15 \text{ kV}$ Unpowered <ul style="list-style-type: none"> • Direct Contact $\pm 6 \text{ kV} \pm 8 \text{ kV}$ • Direct Air $\pm 8 \text{ kV} \pm 15 \text{ kV}$ 	Y	Y	Y
26	Endurance Test	Ambient Temperature, preferably $27 \pm 2^\circ\text{C}$, 28 V, 100 000 cycles. Each cycle shall consist of switching ON & OFF the system with dwell time as follows:	Y	Y	Y

Sr. No	Test standards compliance	Specifications	PIS Signs	Station Signs	PIS Controller
		Dwell time: 10 s ± 1 s (ON condition), 4 s ± 1 s (OFF condition).			
27	USB port over loading test	USB Port Pin No. 1 (+5 VDC) & Pin No. 4 (GND) to be Short Circuited with external wire in "ON" condition as shown below. The System should continue to work without any problem.	NA	NA	Y

32.3. GPS based Tracking Device

GPS Units of following specifications shall be provided for Electric midi-buses.

Following specifications of GPS Units shall be applicable except the camera and MDVR functionality. However. Such Units shall be capable of accommodating the camera and MDVR if future requirement so arise.

The Service Provider shall have to provide the ARAI certificate for this product before initiating the procurement of this product to Authority for approval.

1. System Functions:

- a) GPS Vehicle Tracking
- b) Vehicle Health Status
- c) Driver Assessment
- d) e-mail and SMS communication for configured alarms and events
- e) On –Board Recording and Server Log
- f) Remote Monitoring including Mobile Data Terminal Server/ Client Applications
- g) MIS
- h) Should be able to function independent of Other Systems –However it should be able to provide GPS input to PIS Controller via RS232

2. System Main Elements

- a) Analog AHD Cameras
- b) Emergency Button
- c) Data Logger (Driver Behavior and Vehicle Health)
- d) Driver Display (Live View one or more Camera, Two way voice communication, Text messaging with Voice from back office, Driver Log in/out RFID)
- e) Wifi AP (detachable for depot use)
- f) On-Line UPS (optional)
- g) All 'Applications' will be supplied and licensed for all time use.

3 Wi-Fi AP

- a) Improve working efficiency of system maintenance, saving time and cost.
- b) USB 2.0 interface, plug and play
- c) Support(802.11b/g/n) 2.4GHz LAN -10 Meters
- d) Support 'Easy configuration' via laptop or iOS, Android Mobile Terminal
- e) Image preview for 'adjust angle'
- f) Preview, Playback, Search, Setting

- g) Support external 64 GB SD card file backup
- h) Support Data Export from m DVR
- i) Transmission Rate 20 Mb/s
- j) Power supply from m DVR :500 m A @5V
- k) Operation Temperature: -10deg C ~ +50deg C
- l) Relative Humidity : <80% non condensing
- m) Only a few units required per depot

4 Safe Driving System (data logger)

- a) Integrated 6-axis G-sensor
- b) Data Management , Analysis :Collect data of six-axis sensor and OBD II to manage driving behavior Harsh Acceleration/braking, Sharp Turns, collision and oil consumption, speed, driving time, long idling etc
- c) Data type K line, CAN ISO 11898/ ISO15765-4 high speed, intermediate speed and low speed CAN, RS485, OBD II
- d) Acceleration $\pm 16g$, Angular Rate ± 2000 %/sec
- e) Power supply from m DVR : 500 m A @5V
- f) Operation Temperature: -10deg C ~ +60deg C
- g) Relative Humidity : 95%
- h) Ingress Protection IP 54 minimum
- i) Test compliances : As detailed later in this document

5 Driver Display Unit

- a) 7" TFT LCD Touch Screen with Arrow Keys and Number Buttons
- b) Resolution 800*480 , Live view Video Surveillance
- c) Luminance 400cd/m², Visual Angle 70/70/50/70 (Typ.)(CR dot 10)(Left/Right/Up/Down)
- d) Maximum Number of Display Color 262K/16.7M(6bit/6bit+Dithering)
- e) Scale 16:9
- f) Back-light Type White LED
- g) Built –in Speaker Speaker(16 Ω , 2W)x2
- h) Built-in RFID module to sign in/out, When Driver & Conductor swipe the ID card, then the SERVER will get the information and send a message to driver & conductor (and others) to inform them sign successfully. The same functionality when used in a School Bus will inform parents. Supports standard card of Mifare protocol ISO14443 Type A , working frequency 13.56MHz
- i) Two Way Voice Communication with Back Office
- j) Text Message from Back Office
- k) Live View and Play Back -One or More Camera
- l) 'Reverse camera only' when reverse gear is engaged (via digital I/O)
- m) 'Door Facing Camera only' when 'Door Open" (via digital I/O)
- n) Recording On –Green mark, 'Event' Recording –Red mark
- o) GPS Date/Time/Speed, GPS Loss, Vehicle ID, All 'Events', Channel Name, Ignition Status
- p) Power supply from m DVR: 200 m A@12V
- q) Operation Temperature: -10deg C ~ +60deg C
- r) Relative Humidity: 95%
- s) Ingress Protection IP 53 minimum
- t) Installation Bracket on Dashboard
- u) Test Compliances : As detailed later in this document

6. Performance and Durability Testing & Environmental Test

Test Compliances for Data Logger + Driver Console (together):

Verification Report of ARAI/ICAT/CIRT is mandatory.

Sr. No	Test standards compliance	Specifications
1	Performance parametric test	Nine points, tri temperature/tri voltage- 18V, 27V, 32V,-10°C, room temperature, +70°C test. At each test point the system will be powered on and shut down 5 times as per the supplier's designated procedure and thereafter evaluated for malfunction if any.
2	Cold	IS 9000 (Part II/Sec 4)-1977 (reaffirmed 2004) at -10°C for 2 hours in 'on' condition
3	Dry heat	IS 9000 (Part III/Sec 5)-1977: at + 70°C for 16 hours in 'on' condition.
4	Damp heat	IS 9000 (Part V/Sec 2)1981 at +25°C /+55°C, Humidity 95%, 24 hours for 6 cycles in off condition. Functional test with power in 'on' condition at start of 2nd, 4th and 6th cycle
5	Vibrationstandard AIS 012/AIS:062 -10g	<ul style="list-style-type: none"> • Frequency 5~55Hz and return to 5Hz at a linear sweep period of 1 minute/complete sweep cycle and 10g at maximum frequency • Excursion -1.65 mm peak to peak over the specified frequency range • Test duration 60 minutes Direction of vibration -X, Y, Z axis of device as it is mounted on the vehicle. <ul style="list-style-type: none"> • Test to be carried out in 'on' condition as per ARAI
6	Dust and water ingress protection	IS /IEC 60947-1:2004 in conjunction with IS/IEC 60529:2001
7	Fire resistant harness	<ul style="list-style-type: none"> • Horizontal Burning rate tested as per ISO 3795 , • Flammability Test as per IS:2465:1984
8	Reverse polarity protection without fuse	The component must fulfill the function- and service life requirements after being subjected to reversed polarity up to 27 V for 2 minutes. ISO 17650-2.
9	Over voltage protection	To ensure service life requirements and functionality. The component shall run for 60 minutes at 36V, without effecting the service life or function. ISO 16750-2
10	Insulation resistance	TheInsulation résistancemeasured as per ISO 16750-2 with avoltageof500 V dcshall not beless than 1Mega ohm. Insulation Resistance Test will be carried out after completion of 'Damp Heat Test' and then the Test sample to be kept at room temperature for at least 0.5 hrs.
11	Salt spray test	(AIS: 012/ IS10250) 96 hours
13	EMC/EMI	AIS 004 (PART 3)
14	Operating parameters	Supply voltage 24 V± 25%
15	Slow Increase and decrease (Ramp up/ Down)	Apply a Voltage of 0V to 27V at increasing rate of 0.5V per second for slow Increase of Power Supply. Apply a Voltage of 27V to 0V at decreasing rate of 0.5V per second for slow Increase of Power Supply.
16	ESD Test	Powered <ul style="list-style-type: none"> • Direct Contact ± 6 kV, ± 8 kV • Direct Air ± 8 kV, ± 15 kV Unpowered Direct Contact ± 6 kV ± 8 kV Direct Air ± 8 kV ± 15 kV
17	Endurance Test	Ambient Temperature, preferably 27 ± 2°C, 28 V, 100 000 cycles. Each cycle shall consist of switching ON & OFF the system with

Sr. No	Test standards compliance	Specifications
		dwell time as follows: Dwell time: 10 s ± 1 s (ON condition), 4 s ± 1 s (OFF condition).
18	USB port over loading test	USB Port Pin No. 1 (+5 VDC) & Pin No. 4 (GND) to be Short Circuited with external wire in "ON" condition as shown below. The System should continue to work without any problem.
19	Improper Shut down	Battery supply shall be disconnected in the middle of operation. This shall be repeated for 100 times ON time :- 3~4 min, Off time :- 10 sec

32.4. Integration requirement with Existing ITMS System

Operator shall mount ITS Equipment as specified herein above on Buses. Operator shall also ensure to supply equipment compatible with existing ITS System of Authority so as to enable smooth integration. Operator shall be responsible for regular maintenance ITS equipment installed by it during the Contract Period. Operator and Authority are hereby agree to share interfacing protocols and Active Programming Interface with each other for smooth integration of ITS equipment provided by Operator with Authority's ITS System. Authority shall mount CCTV cameras etc on the Bus through a separate vendor appointed by it.

33. Stop requests:

33.1. A suitable device for the convenience of passengers to request for stopping bus be provided at appropriate locations

34. Bumpers:

34.1. Bus would be provided with front and rear bumpers of Steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system. The bumper would be easily repairable/ replaceable. Bumpers would conform to the requirements of CMVR, AIS (069), and Bus Code/any other international Standards (to be specified by the manufacturer). Details of above bumpers along with drawings including thickness of bumpers, section, profile etc would be supplied by the Successful bidder..

34.2. Bus manufacturer would provide details of materials used, their specifications and process followed for their repair and maintenance along with material required.

35. Towing device:

35.1. Heavy-duty ring type towing devices would be provided in front and rear bumper area with load transfer to bus structural members. Capacity of each towing device would be 1.2 times (minimum) the kerb weight of the bus. The manufacturer would supply a copy of the test certificate of the towing devices

36. Wind Screens:

36.1. Front wind screen in the bus would be in single piece design, plain/ flat with curved corners, PVB film laminated safety glass of minimum thickness of 8.0 mm. Rear windscreen would also be in single piece design, flat in centre and curved on corners

toughened glass of thickness of 5.5 mm (\pm 0.3mm). Windscreen glasses would meet the requirements of BIS 2553: Part II-1992 or latest and that of CMVR and Bus code(AIS 052). The glazing used for fitment of glasses would be Ethylene Propylene Dien Monomer (EPDM) rubber of black colour or pasted with adhesive material conforming to Indian/ International Standards to be specified by the manufacturer. A grab handle and suitable handles on the outside of windshield centre at waist level would be provided to facilitate manual cleaning of the windscreens.

37. Wind screen wipers:

- 37.1. Electrically operated windscreen wiper system having two wiper arms with blades would be provided. Wiper motor would be heavy-duty steel body for minimum of two-speed operations. Wiper arms would rest horizontally when not in use. The sweep angle would be sufficiently wide for clear view during rainy days. Windscreen wiping system would be 24V, having variable speed, with fitment of time delay relay. Windshield washer system would spray washing fluid on windshield & when used with the wipers, would evenly & completely wet the entire wiped area. Windshield washer system would have a minimum of 2.5 litres capacity tank suitably located for easy refilling from inside the bus and two nozzles at suitable location for proper spray of fluid. Reservoir pumps, lines & fittings would be corrosion resistant & reservoir itself would be translucent for easy determination of fluid level. The windscreen wiping system would be in accordance with CMVR/ BIS: 7827 Part1, 2, 3 (section 1, 2) or latest.

38. Fire extinguishers:

- 38.1. Multi purpose fire extinguishers would be ISI marked conforming to BIS: 13849-1993 or latest, dry powder type (Stored pressure) duly filled, of capacity and quantity as per the provisions of GSR-853 (E) dated 19.11.2001 notification of Government of India, Bus Code, UBS II. Fire extinguishers would be encased & fitted with proper reinforcement. The enclosure box would have transparent breakable glass at front cover.

39. First aid kit:

- 39.1. First aid kit complete with items, medicines, bandages etc. would be provided as per provisions of CMVR fitted near driver seat at appropriate position and level on side with proper reinforcement.

40. Provisions for Persons with disabilities:

- 40.1. The manufacturer would provide for ease of accessibility, guidance, anchorage of wheel chairs on-board, positioning of aids etc system for Persons with Disabilities (PwDs) that meets the requirements as given in the Bus Code and CMVR.

41. Battery / power supply system for auxiliary systems / aggregates of bus:

- 41.1. Power supply system for operation of bus aggregates other than electric propulsion system would be 24V of minimum 180 Amps-hour capacity, low maintenance type lead acid batteries or any other source, which shall be brought out by bus manufacturer in his bid. Such supply system would be well secured to a hinged/ pivoted or slide out type carrier for ease of access for repair & maintenance, replacement and suitably ventilated for escape of fumes, if any, but insulated against ingress of dust and moisture. In the event of separate batteries/power supply for these systems, the battery box/power supply system would be appropriately mounted and would be well secured, easily

accessible & ventilated. Performance requirements of batteries would conform to BIS: 7372-1995 (or latest).

- 41.2. In the later case at 41.1. battery terminals, if batteries provided, with positive locking system (e.g. angle type terminal with provision for double bolting) duly protected against all possible short circuit risk would be provided.
- 41.3. Each power supply cable would be covered with flame retardant Grey colour corrugated flexible pipe and would be properly encased & clamped.
- 41.4. A relay controlled Heavy-duty type battery/supply cut-off switch (isolator switch) capable of carrying & interrupting total circuit load would be provided 1 each near battery/supply system / driver on side panelling at appropriate level for disconnecting all battery positives/supply system except for safety devices such as fire suppression system & other systems as specified. Two points of battery/supply cut off switch would be connected with battery/supply source and two points would be connected with self-starter. The battery/supply Cut-off switch with power plant operating, would not damage any components of electrical system in off position. The battery / power supply Cut-off switch would be capable of carrying & interrupting the total circuit load.

42. Electrical equipment and wiring for bus aggregate supply system/ source:

As per details given in UBS II and generally as under:

- 42.1. The bus would have 24 Volt D.C with multiplex wiring system for all its electrical equipments except in unavoidable circumstances to avoid sparking in buses. A separate system/ mechanism would be provided for discharge of electro static charge induced during the operation of vehicle. Adequate precaution would be taken in case of single pole wiring to avoid spark in any of the items etc.
- 42.2. An adequate capacity power supply system / source of 24V DC, minimum 150Ah rating with consistent output to take care of high idling periods of city operation would be provided and so located as to minimise ingress of oil or rain water into it. Bus Manufacturer may, if so required, have to install two separate power supply systems / sources one each for Air Conditioning System and bus Auxiliary systems.
- 42.3. Details of specifications of Battery / power supply sources for vehicle auxiliary systems / air conditioning etc, the starting mechanism, if any, along with circuit diagrams would be furnished by the manufacture along with their bids.
- 42.4. Electrical equipment and wiring would conform to Indian/ international Standards, bus code and UBS II. All cabling would be as per provisions of Bus code / UBS II. The wiring would be multiplex system, flame proof, ISI marked conforming to BIS: 2465-1984 or latest. As far as possible electrical system would be 24V double pole multiplex wiring system except in unavoidable condition. However, in case of single pole wiring all power & ground wiring would have double electrical insulation, which would be waterproof conforming to the Indian/ International Standards. Wiring would be grouped, numbered & colour coded. Wiring harnesses would not contain wires of different voltage classes unless all wires within the harness or insulated for highest voltage present in harness. Kinking, grounding at multiple points, stretching & exceeding minimum bend radius would be prevented.
- 42.5. Wiring looms/ harness for electrical system of bus would be properly routed, encased/ concealed type so mounted to eliminate chances of any spark. Details of above wiring loom including circuit diagram; layout of controls etc would be supplied by the bidder along with the bid Wiring support would be protective & non-conducting at areas of wire contact & would not be damaged by heat, water, solvents or chafing.

- 42.6. All electrical fittings and lights would be fully wired up, running in flame retardant black colour PVC sleeves as per applicable Indian Standards (to be specified by the manufacturer) and installed in a manner to facilitate easy inspection/ rectification/ replacement etc as & when required without disturbing internal finish/ décor of the bus. Whenever any wire or cable or PVC sleeve carrying cable etc passes through holes in sheet metals/ structural member, suitable rubber grommets/ Bakelite inserts would be provided in these holes to avoid direct contact between cables and sheet metal causing damage to insulation coating.
- 42.7. Bus manufacturer would furnish details of above wires/cables and battery / auxiliary items supply system cables.
- 42.8. Design of electrical, electronic & data communication systems would be modular so that each major component, apparatus panel or wiring bundle is easily separable with Standard hand tools or by means of connectors. Each module except main body wiring harness would be removable & replaceable. Power Plant wiring would be an independent wiring module. Replacement of power plant compartment wiring module would not require pulling wires through any bulkhead or removing any terminals from the wires.
- 42.9. Electrical system & its electronic components would be capable of operating in area of the vehicle in which they will be installed. Electrical & electronic equipments would not be located in an environment that will reduce performance or shorten life of the component or electrical system. No vehicle component would generate or be affected by electro-magnetic interference or radio frequency interference (EMI/RFI) that can disturb performance of electrical / electronic equipments.
- 42.10. Bus manufacturer would furnish recommendations regarding methods to prevent damage from voltage spikes generated from welding, jumps start shorts etc.
- 42.11. All electrical & electronics hardware would be accessible & replaceable easily. It would be mounted on an insulating panel to facilitate replacement. Mounting of hardware would not be used to provide sole source ground and all hardware would be isolated from potential EMI/ RFI.
- 42.12. All electrical/ electronic hardware mounted in interior of bus would be inaccessible to passengers & hidden from view unless intended to be viewed.
- 42.13. All electrical/ electronic hardware mounted on exterior of bus i.e. not designed to be installed in an exposed environment would be mounted in a sealed enclosure.
- 42.14. All electrical/ electronic hardware & its mountings would comply with shock & vibration requirements.
- 42.15. Bus manufacturer would provide a certificate of testing/estimation of electrical load for each system.
- 42.16. Electric supply systems' over voltage output protection would be provided.
- 42.17. All branch circuits would be protected by circuit breakers or fuses sized to requirements of the load. Circuit breakers or fuses would be sized to larger than total circuit load current as per UBS II. Current rating for wire used for each circuit must exceed size of circuit protection being used.
- 42.18. Electronic Circuit protection for power supply for starting mechanism / device if any would be provided to prevent engaging of for long time / to prevent overheating.

- 42.19. To the extent practicable, wiring would not be located in environmentally exposed locations under the vehicle. Wiring & electrical equipments necessarily located under the vehicle would be insulated from water, heat, corrosion & mechanical damage. Where feasible front to rear electrical harnesses should be installed above the window line of vehicle.
- 42.20. All electrical motors/subsystems would be easily accessible for servicing.
- 42.21. Separate additional out-lets, as required in UBS II, are to be provided with appropriate relays & fuses in wiring harness for fitment of electrical auxiliary devices/ systems to be added later on in buses, if required.
- 42.22. AC (Alternating Current) out-let of 220V, as required in UBS II if any, be provided at suitable location for charging of electrical/electronic equipment, etc.
- 42.23. If any electronic components have an internal clock, it would be provided with its own power supply back up to monitor time when electric propulsion system power is disconnected.
- 42.24. All electronic components/equipment would have self-protecting capability in event of shorts in cabling and also in over voltage and reverse polarity conditions. If an electronic component is required to interface with other components it would not require external pull up and/ or pull down resistors.
- 42.25. RF components such as global positioning system (GPS) etc. whenever provided would use coaxial cable to carry the signal. The RF systems require special design consideration for losses along the cable. Connectors would be minimized, since each connector & crimp has a loss, which will attribute to attenuation of signal. Cabling should allow for removal of antennas or attached electronics without removing the installed cable between them.

43. Lights and lighting system:

- 43.1. Interior saloon lighting would be sunken type light assembly fitted with LED lights and mounted in staggered formation for uniform lighting in two separate circuits. First row of lamps provided in driver's cabin should be fitted with amber internal filter to reduce glare to driver at night.
- 43.2. Modern rectangular type headlamps with relay and side light etc would be suitably styled into front-end construction.
- 43.3. White and Red marker lights of 5 Watt each would be fitted at both top side corners of the front and rear panel of the bus respectively.
- 43.4. Identical signal lights of 15 Watts would be fitted for inter-changeability in each side i.e.; front, rear and side respectively
- 43.5. Brake lights (15 W) and taillights (10W) would be two separate lights to reduce heat generation.
- 43.6. Reverse light of 25W, square lamps with white covers would be provided.
- 43.7. Side markers would be provided on both sides as per bus code/ AIS 008
- 43.8. Rear signal lights, brake lights, taillights and reverse lights would be arranged vertically.

- 43.9. Light wattages given above are indicative, however, all the lights and lighting systems would conform to requirements of Bus code, CMVR/Gujarat MVR / UBS II and other relevant AIS Standards.
- 43.10. Following lights would be actuated when the headlight are 'ON' and the doors are 'Open':
- i Lights provided for illuminating exit/entrance door area, lights would illuminate outside area up to at least one meter when door/doors is/are opened. Lights for exit/entrance door areas would be flushed as far as possible to avoid tripping of passengers, protrusions if any would conform to relevant CMVR/ AIS Standards.
 - ii Exterior door lights
 - iii Lights would be automatically switched off when the door is closed.
- 43.11. A well-lighted bus registration number plate would be fitted at rear as per provisions of CMVR duly complying with directives/ regulations regarding high security number plates as notified by Government of India / Government of Gujarat if any.
- 43.12. No Electrical fittings would be mounted on front and rear bumpers.
- 43.13. Switches would be fitted on right hand side of instrument panel through evenly loaded circuits & fuses as per bus code.
- 43.14. A reverse buzzer would be installed at the rear of bus to sound intermittently when reverse gear is engaged.
- 43.15. A suitable light would also be provided in electric propulsion system compartment for ease of maintenance/ emergency repairing.
- 43.16. Following circuit diagrams would be supplied along with buses:
- i) Complete circuit drawings for exit/entrance door control system, door mechanism.
 - ii) Complete door sensor electrical circuit drawing.
 - iii) Complete circuit drawing for sensitive door edge system.
 - iv) A layout drawing for all door control switches, gauges, warning lights on driver's dashboard.
 - v) A layout drawing for all lighting and wiring circuits, control switches fuses and fitment details and diagrams along with item specs and types in each case.
 - vi) Complete circuit diagram for the electric propulsion system inter-alia highlighting high, medium and low voltage cable, safety / protection systems, etc

44. Performance statement:

- 44.1. Bus manufacturers would furnish following information for performance evaluation of bus chassis and/ or complete buses supplied to other customers and now in service for at least 5 years. The information should be furnished separately order wise:
- a) Type/Model
 - b) Name and address of the bus operating agencies where this model is operating
 - c) Number of the buses supplied
 - d) Order no. against which buses have been supplied.

- e) Date of supply and date from which in service
- f) Maximum/minimum turning radius.
- g) Maximum climbing ability/ gradeability
- h) Type of bus body
- i) Electric propulsion system details such as max power, battery data, usable power, max min battery charging and discharge data, controllers, safety devices/provisions, SPECS AND STDS against each item,
- j) Electric propulsion system - load speed performance curves and data, range (Kms) between two consecutive charging,
- k) Battery charging system, charging rate, charging time, types of batteries, battery pack mountings, etc
- l) Specific energy consumption – bus kms operation per unit energy(kwh) consumed, specific weight of batteries (weight per kwh rating), annual deterioration factor of batteries with age wrt specific energy consumption,
- m) GVW of buses
- n) Noise emission Norms
- o) Type of suspension system
- p) Dimensions- Length, width, height, floor height, wheel base,
- q) Angle of approach, departure and ramp over
- r) Axle –rear and front
- s) Passenger carrying capacity – seated and standees as worked out by using AIS 052
- t) Any other performance data.

45. Technical information

Technical information required to be furnished by bus manufacturers along with Bid wrt the following amongst others:

- 45.1. Bus manufacturer's technical information of the bus i.e. General Drawings comprising of elevations –sides, front & rear ends along-with main dimensions i.e. overall length, overall width, overall height, saloon height, pillar to pillar distance, isometric views, exterior & interior details, seating layouts, no. of seats (excluding seat for driver), environmental friendly colour scheme as per AJL etc would submit same along-with the Bid.
- 45.2. General appearance & structural details of roof, floor, sides, front & rear show and driver's cab would be provided by the bidder along with their bids. Details of main structural members, material specifications, shape, size, thickness, etc be indicated on the above drawings.
- 45.3. Power Point presentation material on a DVD for offered design of bus (indicative) and minimum 1:15 scaled Model (indicative & non-working) duly furnished/ painted in environmental friendly colour scheme as given by AJL would be submitted along-with the bid. The presentation will cover elevations –sides, front & rear ends along-with main dimensions, isometric views, exterior & interior details, seating layouts, colour scheme etc.

46. Tools, Gauges and Testing Instruments:

- 46.1. Bus manufacturers would furnish a list of special tools, gauges and testing instruments for inspection, repair and maintenance of buses along with a complete list of spare parts recommended for:
 - Normal wear and tear; and

- Emergency requirements for any breakdowns, damages etc.

47. Operation and Maintenance Manual:

- 47.1. At least 2 hard bound copies, for every 25 buses or part thereof, of operation and maintenance manual containing essential technical information required for satisfactory operation, inspection and maintenance would be supplied by bus manufacturers.
- i. One set of Coloured wall charts would also be provided of following units for every ten buses or part thereof showing assembly details:
 - ii. Chassis lubrication and brake system.
 - i. One set of Coloured wall charts of following units amongst others for every 25 buses showing assembly details:
 - Electric propulsion system, batteries / packs, motor,
 - Traction Controller system, power input system for auxiliary systems/aggregates of bus
 - Drive line and Rear axle
 - Front axle
 - Steering system, suspension system, etc
 - Brake system, ABS etc
 - Regenerative braking system
 - Safety devices
 - Bus AC System
 - Any other necessary for skill development of operator staff

48. Training

- 48.1. For each lot of up to 25 buses or part thereof, bus manufacturer would arrange orientation training at Ahmedabad for two days for 60-70 drivers in batches of 20-25 (up to a total of 150 man days) besides similar orientation training at Ahmedabad for 3 days for 50 technicians/ supervisors/ engineers in batches of 25 (Total 75 man-days).
- 48.2. Bus/ energy/ available facilities will be provided by Bus Operator and course materials will be provided by bus manufacturer on free of cost basis. This training will be provided free of cost, as and when required by AJL / Bus Operator within one year of purchase of buses.

49. Tool kit

- 49.1. Bus manufacturer would provide a suitable tool kit and other mandatory items as per CMVR 138 (4)/ other applicable rules comprising of common tools and other essential items required. Complete list of tools in tool kit to be supplied with every bus would be supplied by the manufacturer. One Hydraulic Jack per bus of a capacity of at least 10 Ton as per design of bus would also be supplied.

50. Inspection and Testing:

- 50.1. Bus may be inspected at various stages of fabrication by AJL 's representative at manufacturer works. Inspection would comprise of ensuring that all materials, components, items, accessories and assemblies used in fabrication of buses conform to contractual specifications. Wherever required to ensure this, laboratory test would be carried out at bus manufacturer's cost.
- 50.2. The inspection may be undertaken at any and or all stages such as component fabrication stage, chemical pre-treatment stage, fabrication of assembly, sub assembly stage, structure, panelling and equipping stage and Pre-dispatch inspection.
- 50.3. Final Inspection of buses would be carried out at manufacturer's facilities and or at a place finalised by AJL. After the bus is finally inspected, it would be subjected to test run and trials as required by AJL
- 50.4. The bus would be taken over by AJL after satisfactory final inspection, testing and trials in Ahmedabad.

51. Maintenance Spares and Materials

- 51.1. Bus manufacturer would provide details of components/spares required for maintenance of vehicle for twelve months' operation taking daily utilisation of bus of up to 230 Kms.
- 51.2. Manufacturer would also provide complete details of vendors, for every component/ spares for complete bus and the spare parts catalogue in 2 sets for every 25 buses or part thereof.
- 51.3. Manufacturer would ensure that during service life of 10 years or 8, 00,000 Kms. (whichever is later) of service, adequate spare parts in kit form/ individual components are made available in time to AJL on demand along with other essential items required.
- 51.4. All spare parts availability would be more than 95% at any time

52. Maintainability

- 52.1. Design and fabrication of bus would be such as facilitates easy access for repair & maintenance, removal, replacement of various bus components/ assemblies/ sub-assemblies/ systems by providing suitable traps/ flaps etc. Also removal and re-fitment of electric propulsion system , traction controller system, differential, battery cooling system, door closing mechanism, PIS etc. would be easy for repair & maintenance purpose. Enough space would be provided between wind screen glasses and PIS boards for facilitating cleaning of glasses.
- 52.2. Battery cooling system coolant top up/ filling and electric propulsion system charging inlets would be easily accessible with suitable closing devices complete with locking arrangement/-holding arrangement.
- 52.3. Also an easy access would be provided for attending to other assemblies mounted in the vehicle.

53. Warranty/ Guarantee

- 53.1. Fully built bus would be covered under Warranty/ Guarantee for up to 1, 50,000 Kms. or 24 months whichever is later from the date of putting bus into operation after registration. All assemblies, sub-assemblies, fitments, components would be covered

under Warranty Period as per commitment of bus manufacturer at the time of supply of bus.

54. General requirements:

54.1. AJL reserves the right to alter, modify, change specifications as per requirement to suit the latest provisions of CMVR/ any other Notifications, safety aspects, regulatory aspects besides any practical/ operational difficulties etc. faced/likely to be faced by AJL . Vehicle Manufacturer would ensure that all alterations, changes or modifications in specifications, if necessary, as mentioned above would be carried out in buses built by them as per the advice of AJL without attributing any additional cost.

54.2. Ministry of Road Transport & Highways, Government of India (MORT&H) vide Notification No.GSR-853 (E) dated 19.11.2001 in the Gazette of India, inter-alia stipulated the following measures which need to be complied with for enhancement of safety by the Vehicle Manufacturers as per the statutory requirement for registration of vehicles

- While registering every bus, Vehicle Manufacturers & transport authority would jointly examine the bus prior to registration. The registration of such a vehicle be done only after signing the report jointly by all concerned along with the transport authority.
- For electrical installations, flameproof cables would be used, especially positive terminals would be locked firmly with all cables & pipes with proper looming to take care of vibrations, fire retardant material would be used for seats, roof & sidewalls. Safety instructions about fire hazards would be displayed.
- Details of structural members, their material specifications & dimensions i.e. cab & saloon flooring, cross bearers, various angles, floor longitude, main body pillars, dummy/stump pillars, cant rail, vent rail, waist rail, skirt rail, wheel arch section, sole bar, seat rail, roof sticks & roof longitudes, diagonal bracing, Rub rail tube, stretch & body panel stiffeners, gussets etc. would be provided by bus manufacturers.
- Similarly, details of aluminium sheets/sections & their alloys/specifications, aluminium sheet, rub rail, decorative mouldings, wire cover, wearing strips, footsteps edging, various panel beadings, window frames and its sections, finishers, water gutter channel, roof grab rail brackets would be provided by bus manufacturers.
- All edges would be rounded off and would not cause injury to bus occupants.
- Complete bus would be rattle-free.
- All the rivet and bolt holes would be jig drilled as far as possible. The rivet holes should be drilled before the corrosion treatment. Holes drilled after the corrosion treatment be suitably treated with

anti corrosion materials. Rivet heads neatly formed and each bolt/ rivet would be tightened after full mating of the surfaces to be fastened.

- All safety aspects should be considered while designing and fabricating the bus.
- Continuous length piano type hinges and tower bolts of stainless steel would be used as per relevant Indian Standards.
- Similarly Aluminium extruded sections wherever not painted would be anodized.
- All flaps wherever provided should have heavy-duty support to keep it open for ease of maintenance.
- All miscellaneous M.S pipes would be phosphated with the coating of 2.16 to 2.70 gm/m² or by any other pre-treatment process conforming to Indian/ international Standards (to be specified by the manufacturer). Samples of all materials & components would withstand a two weeks (336 hours) Salt Spray test in accordance with ASTM procedure B117 with no structural detrimental effect to normally visible surfaces & no weight loss of over 1%.
- Anodized decorative aluminium mouldings/ beadings etc would be used.
- All M.S pipes used in the bus would be ERW conforming to BIS 3601:1984 or latest, of grade WT –160.
- All rubber items used on the bus body would be made of Ethylene Propylene Dien Monomer (EPDM) rubber of black colour conforming to the Indian/ International Standards to be specified by the Manufacturer.
- EPDM rub rail of aesthetic profile would be fitted in anodized extruded aluminium channel between stretch panel and skirt rail longitudinally at the widest portion of the bus. The quality of EPDM material would be as per the Indian/ International Standards to be specified by the Bidder.
- Every trap/-opening flap would be secured in a manner that the vibrations can't dislodge it. Lifting devices must not protrude above the flap.
- Ease of accessibility to electric propulsion system & other aggregates for easy maintenance would be ensured. Assemblies / units would be so mounted that they are easily accessible & can be removed without disturbing other components / assemblies.

- All structure, body, and panel-bending mode frequencies, including vertical, lateral, and torsional modes, would be sufficiently removed from all primary excitation frequencies to minimize audible, visible, or sensible resonant vibrations during normal service.
- Exterior protrusions if any would conform to the provisions of relevant CMVR/ AIS/ Bus Code. The exterior rear-view mirrors and required lights and reflectors are exempted from the protrusion requirement. Advertising frames would protrude no more than 22mm from the body surface and would have the exposed edges and corners rounded to the extent practicable. Grills, doors, bumpers and other features on the sides and rear of the bus would be designed to minimize the ability of unauthorized riders to secure footholds or handholds. The exterior body features would be shaped to allow complete & easy cleaning by automatic bus washers without snagging washer brushes or retaining water & dirt.
- Hydraulic Grease Nipples would be provided for ease of proper lubrication & maintenance.
- Front panels, bumpers and grill should be designed such that there are no pointed or sharp protrusions to minimise injuries to vulnerable road users in case of impact.

55. Quality assurance

- 55.1. Bus manufacturer would use materials including fasteners conforming to relevant Indian/ International Standards and would get the same tested before use, meeting requirements of all specified parameters to ensure quality of material specified. However, random sample of materials picked up and duly sealed by representative of AJL in presence of bus manufacturer, out of purchased lot at works of the manufacturer or out of the bus under fabrication/ completed bus and be sent for testing quality of components at CIRT, Pune/ARAI/BIS approved testing laboratories having testing facilities for testing all parameters of specifications of materials/ items. In the event of failure of samples in lab tests, testing would be conducted in same way again from fresh lot. The bidder would replace failed materials by those duly passed in lab tests.
- 55.2. In the event of failure of material/ items in laboratory test, failure of material/ items (removed from completed bus) in laboratory test, acceptance decision about bus be taken by AJL after obtaining compensation/ recoveries of liquidated damages from bus supplier as per system decided by AJL .Wherever, failure of material on one parameter or more than one parameter, recoveries for complete lot of materials used in bus would be made from manufacturer plus 20% damages thereof.
- 55.3. Completed bus would be subjected to water leakage test conforming to BIS: 11865-1986 or latest.
- 55.4. Add list of items to be tested for bus bodies as had been given earlier

56. Statutory Requirement

- 56.1. Bus manufacturer would ensure that all statutory requirements in respect of each and every item of bus are fully met. Manufacturer would also obtain type approval certificates etc. for bus & any other items from testing agencies specified in the CMVR namely Vehicle Research & Development Establishment, Ahmednagar of the Ministry of Defence of Government of India or Automotive Research Association of India, Pune or Indian Institute of Petroleum, Dehradun and or any other agencies as specified by the Central Government on date of testing/ type approval or any other agency specified by competent authority. A certificate showing details of make/type/model of various units like electric propulsion system items, Traction Controller system items, rear axle, batteries, tyres, steering, instruments on the panel, air compressor, shock absorbers, suspension system items, etc. would be furnished.
- 56.2. Bus Manufacture/ Bodybuilder must make sure that the Fully built bus complies with standards and regulations for Electrically propelled vehicle provided in the AIS-052, AIS 024, AIS 028, any other applicable standard; CMVR 1989 as amended till date, CMVR 1989 and Gujarat MVR 1989 and all amendments thereto.

57. Manufacturer's nameplate

- 57.1. Manufacturer's nameplate may be fixed as per approval of AJL.

58. Vehicle Guidance system for properly aligning bus with bus stops / gates:

- 58.1. The Automatic Sliding Door (ASD) is a standard feature of the BRTS Station. For supply, installation and servicing of the same, AJL has appointed an ASD vendor. Such Vendor will supply RFID based vehicle guiding / gate synchronising system for proper aligning / synchronising of entry / exit gates of bus with those of BRTS bus stations, for ease of boarding / alighting of passengers at bus stations. **The bus manufacturer has to make provision for affixing RFID TAG on the driver side glass on door window.**

59. Bus Air Conditioning System

- 59.1. Air conditioning system capable of maintaining prescribed cabin temperature while operating even in harsh ambient conditions of 45 – 48 degree C ambient temperature, dusty and humid conditions in Ahmedabad city.
- 59.2. Power required for air conditioning system operation should not adversely affect operational performance of bus particularly wrt its acceleration, Gradability, load pulling capability, etc. even when the bus is loaded to capacity and the air conditioning is on.
- 59.3. Bus entry exit doors are assessed to operate (Open, dwell, close for a average period of 45 seconds each time)at headways of about 2 minutes, for boarding/ alighting etc of passengers.
- 59.4. Estimated Peak hour load in bus may be considered as at 1.5 times bus capacity
- 59.5. Air conditioning system's test reports as provided in UBS II / as given in this doc be submitted. On site testing may be undertaken by AJL at their discretion and Bus supplier would make all arrangements for the same at their cost.

60. Any other provisions to make the bus fully functional.

- 60.1. Notes indicated in this doc form part of the specs / bus body building requirements. Should however there be any conflict details contained in notes would over-ride others.

61. Specifications related to Fire Detection and Alarm System (FDAS) General Requirements

- 61.1. FDAS provision is to be made in the bus at appropriate location(s) for detection and alarming about any likely fire at all fire prone systems (bus supplier to identify such fire prone systems and make above provisions)
- 61.2. Vehicles shall be equipped with fire detection & alarm system detecting fires in the fire prone areas based on sensors that senses either abnormally high temperature or rate of temperature rise, or both.
- 61.3. Upon detection of fire in the fire prone areas, the system referred in clause no 1.1, shall provide the driver with both an audio and a visual signal, and activate the hazard warning signal. The placement of the visual alarm shall be such that it is visible unobstructed while viewed from the driver seat.
- 61.4. The detection & alarm system shall be operational irrespective of whether electrical propulsion system of bus has been started and the vehicle's attitude.
- 61.5. The installation of the fire detection & alarm system shall comply with the following requirements;
- 61.6. The fire detection & alarm system shall be installed according to the system manufacturer's installation manual.
- 61.7. An analysis shall be conducted prior to the installation in order to determine the location of fire detectors and alarm system. Potential fire hazards within the fire prone areas shall be identified such that the fire detectors shall be positioned to cover the fire hazard. The system shall also be ensured to work properly regardless of the vehicle's altitude, road conditions etc.,
- 61.8. Fire hazards to be taken into account in the analysis shall at least consist of the following: Components whose surface may reach temperatures above the auto-ignition temperature for fluids, gases or substances that are present in the fire prone areas and electrical components and cables with a current or voltage high enough for an ignition to occur as well as hoses and containers with flammable liquid or gas (in particular if those are pressurized). The analysis shall be fully documented.
- 61.9. The Fire Detection and Alarm System (FDAS) installed in the BRTS Buses shall comply with the requirement of AIS 135, UBS II as applicable, CMVR and other relevant standards as well as best market practices.
- 61.10. Make, model, specs etc of various components / sub-systems / system of FDAS be clearly indicated for each item as part of the offer..A detailed drawing of the system details / specs be also provided for.

62. Electric Bus Battery charging requirements

- 62.1. The Electric Buses shall be operated with Single/Multiple Charging throughout the day depending on the solution worked out. The Buses shall be available for charging during

night after completion of scheduled trips. The Bus Operator is required to install and operate adequate charging stations at the Depot/Parking space provided by the Authority.

62.2. Under No circumstances should the performance of the buses suffer in case of low battery charge status. If buses showing are such performance, Operator shall have to forthwith remedy the situation, shall attract damages and persistent and repeated failures on this count shall constitute a material breach of the performance conditions.

62.2.1. Authority will make bulk power available at identified Spaces for parking, charging and maintenance. Operator will arrange for site level distribution of power to its charging points along with related equipment and infrastructure for charging including any civil and other ancillary work required for parking, charging and maintenance. The decision on number of chargers to be provided is left to the Operator according to his solution. The Operator is expected to pay for the power itself. Information regarding Electricity Rates applicable may be obtained directly from Power suppliers Torrent Power Ltd. (for Ahmedabad city) and Uttar Gujarat Vij Company Ltd. (UGVCL) (for outside Ahmedabad city limits). Operator /Service Provider will present the best solution in terms of bus, capacity of batteries, charging infrastructure required, charging time etc. looking to the operational requirements of BRTS.

62.2.2. The Operator will support the procurement, supply, operation and maintenance of the Bus including battery charging, maintenance /replacement in all respects throughout the Agreement Period. It will make its appropriately trained and qualified technical staff available for any solutions, challenges and fine tuning.

62.2.3. Bidder must provide details of his proposed solution in terms of charging time, charging stations requirement, space requirements, scheduling and charging plan etc.

62.3. Bidder must commit to keep upgrading his technology is and as required based on approval of Authority.

PART II – Specifications of Pure Electric AC Midi bus for Ahmedabad BRTS– generally as per UBS II and Bus code (AIS 049/52)

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications Midi buses	
A	B	C	D
1	Bus Floor heights in mm	900±10 mm, shall be uniform inside the Bus	Confirm
2	Propulsion System	Electrically propelled bus using Electric propulsion system	Confirm and provide details
2.1	Type of Batteries	–Li ion or Li ion Iron Phosphate or Li NMC	Confirm type
2.2	Battery pack rating and energy / power available for propulsion; Any deterioration in propulsion power with usage and consequently reducing charge; Min & max charging % Maximum Thirty Minutes Power (kW)	Kwh and KW for propulsion; Deterioration factor along with performance curve; Minimum discharge level & max charge level:	i. Battery pack Rating ii. Power for propulsion: iii. Deterioration factor: iv. Performance curve – battery charge level vs power available for propulsion: v. Minimum and max charge levels: vi. Maximum Thirty Minutes Power (kW)
2.3	Battery cooling system	Efficient and robust battery cooling system calling for minimal maintenance	Type and specs; Coolant used; Optimal temperature range to be maintained:
2.4	Battery life (No. of charging cycles)	Batteries to last with life of bus i.e. 8 years	No. of full charge cycles; No. of partial charging (top ups) cycles; Time per full & per top up charge: Life of batteries in years:
2.5	Batter Charging System	To be decided by the Bus Operator	Make: Type: Rating
3	Electric drive motor/s	Optimal rating, type, make, model of electric drive motor requiring minimum maintenance	Type : Nos: Rating: speed-load curve: Make: Model: Mean time between major overhauls: Life in yrs: Input power details:
3.1	Electric propulsion		1. Make and model of

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses	
	system motor rating / power sufficient to provide:		motor----- 2. Power rating and max torque and respective rpms
A	Rated performance at GVW in a stop/start urban operations	Attain bus speed of 70 ± 5 kmph (without speed limiter) at GVW load, air conditioning and other sub-system operational. Attain maximum speed of 75 kmph (without speed limiter) and 50 kmph (with speed limiter)at GVW load and air conditioning system operational	bus speed ---- kmph
B	Acceleration (meter/sec ²)	≥ 0.8	Confirm
C	Attain Bus speed of 0-30 kmph in seconds	≤ 10.5	Confirm
D	Maximum speed	maximum speed without speed limiter to be 70 ± 5 kmph as at 3.1.a. Maximum speed without speed limiter and 50 kmph (with speed limiter) to be 75 kmph as at 3.1.a Speed Limiter for the above limit is mandatory for BRTS operations as per direction Hon'ble High Court of Gujarat	Confirm
E	Minimum Operation Range per bus per day	230 km	
F	Grade ability from stop at GVW and air conditioning system operating.	17%	Confirm
G	Rated HP/torque preferably at lower rpm range	Rated HP at low rpm and Maximum torque required at lower range of motor RPM and spread over a wider range of RPM	1. Motor HP ---- at ---- rpm & 2. Motor peak torque --- - NM at ---- rpm; 3. Range of rpm---- to--- - for peak torque
H	Power requirements for Air conditioning system, ITS, etc	Required to be provided by electric propulsion system	power required for air-conditioning system at full load and extreme environmental conditions:
3.2	Noise norms	latest as applicable	Indicate norm vvalue & Confirm
3.3	electric propulsion system management	Electric propulsion system / subsystems (batteries) temperature, motor speed in RPM, vehicle speed, Motor %	Confirm

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details
S. No.	Description	Specifications
		Midi buses
		load (torque), diagnostic message (electric propulsion system batteries, cooling system, motor, Traction Controller specific)
3.4	Electric propulsion system operational requirements	Electric propulsion system should be able to operate efficiently at ambient temperatures / environmental conditions of Ahmedabad generally operating in the semi arid zone prevailing in the area.
3.5	Electric propulsion system / subsystems location	Optional
3.6	Traction Controller / Transmission	Automatic or manual; minimum 5 forward and one reverse speed. Neutral during stops
		Make --- model ----- of Traction Controller / Transmission system 2. No. of forward speeds and their details
4	Operational safety	Traction Controller / Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary.
5	Rear axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations
		1. Make --- model ----- of Rear Axle 2. Type -- 3. Gear ratio ----
5.1	Front axle	Heavy duty reverse Elliot type axle suitable for bus floor height
		1. Make --- model ----- of Front Axle 2. Type --
6	Steering system	Hydraulic power steering
		1. Make --- model ----- of Steering system 2. Type --
7	Suspension system	Waveller spring suspension at front and air suspension system at rear axle
		Confirm:
7.1	Front	Waveller
		1. Make --- model -----, 2. Type – specs ---size--
7.2	Rear	Air suspension
		1. Make --- model -----, of Type – specs --- size---
7.3	Kneeling (mm) applicable in case of air	required on near side
		Quantum of kneeling:

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details	
S. No.	Description	Specifications	
		Midi buses	
	suspension		
7.4	Anti roll bars/stabilizers	Both front and rear	Confirm
7.5	Shock absorbers	Hydraulic double acting 2 each at front & rear	1. Make --- model -----, of shock absorbers 2. Type – specs --- 3. Confirm
8	Braking system	Disc Brakes in front and Drum brakes at rear wheels. Graduated hand controlled, spring actuated parking brakes acting on rear wheels. Asbestos free brake linings / Pads at all places.	1. Confirm : - fitment of drum brakes at Front & disc brakes at Rear: i. Hand brakes: ii. Asbestos free lining: 2. Provide Makes / -----, model-----, specs--- of brake system and its subsystems
8.1	Anti skid anti brake locking system (ABS)	Required	1. Provide Make -----, model-----, specs--- of ABS
9	Electrical system for bus ancillaries	24 volt DC	Confirm: Details of on board system:
9.1	Devices to operate on-board bus ancillaries:	Low maintenance type lead devices to provide 24 V, 150Ah rating system- performances as per BIS:	1. Confirm 2. Make --- model -----, of device 3. Type – specs --- 4. Rating ---- Ah
9.2	Electrical wiring & controls –type	Multiplexing type -- As specified separately under ITS specifications	Confirm and provide details. Provide details of certifying agencies who had certified the multiplexing system design.
10	Speed limiting device	Electronic type duly approved/certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit	1. Make --- model -----, of speed limiting device 2. Type – specs ---
11	Tyres	Steel radial tube-less tyres– size and ply rating for urban operations as per CMVR Standards	1. Make --- model -----, of tyres 2. Type –Size---, specs --- 3. Tread pattern for front---- & for rear tyres---

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses	
12	Bus characteristics		
12.1	Bus dimensions in mm		
A	Overall length (over body excluding bumper)	9200 ± 200 mm	Confirm and provide dimensional details
B	Overall width (sole bar/floor level- extreme points)	2450 ± 100 mm	Confirm and provide dimensional details
C	Overall height (unladen- at extreme point)	3800 mm max	Confirm and provide dimensional details
D	Wheel-base	5000±200mm	
I	Front overhang	45% of wheel base limited to 2000mm	Confirm and provide dimensional details
li	Rear overhang	< 60% of wheel base limited to 2400mm	Confirm and provide dimensional details
12.2	Turning circle radius (mm) - minimum	As per CMVR	
12.3	Floor height above ground (mm)	900 ± 10	Confirm and provide dimensional details
12.4	Clearances (mm)		
A	Axle clearance(mm)	Minimum 190 mm	Confirm and provide dimensional details
B	Wheel area clearance(mm)	> 220 mm for parts fixed to bus body &> 170 mm for the parts moving vertically with axle.	Confirm and provide dimensional details
C	Minimum ground clearance at GVW	Within the wheelbase not less than 240mm.	Confirm and provide dimensional details
12.5	Angles (degrees)		
A	Angle of approach (unladen)	Not less than 8.0°	Confirm and provide dimensional details
B	Angle of departure (unladen)	Not less than 8.5°	Confirm and provide dimensional details
C	Ramp over angle (half of break-over angle)unladen	Minimum 4.8°	Confirm and provide dimensional details
13	Bus Gates/Doors		
13.1	Entry exit gates with doors		
A	Operating mechanism	Electro pneumatically controlled	1. Confirm 2. Make -----, model ---- type --- & specs ---- of operating mechanism
B	Maximum opening / closing time in seconds per operation	4	Confirm and indicate closing / operational time
C	Positions of door controls	As per AIS 052	Confirm
D	Passenger safety system - allowing bus motion only on doors closing	√	Confirm and indicate type of system provided

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses	
13.2	Entry/Exit door – between wheels (near side/non driver side);	Required in the middle of the wheel base. Options to be provided by the Selected Bus Operator/ Chassis manufacturers /Bus Body builder	
A	Door aperture in mm	800 mm as per AIS 052	
B	Clear door width (fully opened)	≥650mm as per AIS 052	
C	Door height	1900 mm as per AIS 052	
D	Fixed partition between gates - full height	Required	
	Width of partition in mm	≥500 adequate to support positioning of conductor seat with piped support on both sides. Also suitable as hand hold for boarding / alighting pax	
	Location of partition	Vertical centre line of the partition is centre line of wheel base– ref details at annexure 'A1' of Part II	
E	Positioning doors with respect to partition.	One on each side of partition	
F	Number of gates	2 Minimum one and maximum two	
G	Positioning doors	As at d above To be proposed by Selected Bus Operator/ Chassis manufacturers /Bus Body builder	
13.3	Location of Entry / exit gates on driver side (off-side)– between wheels	Location on off- side/driver side (to match height of platform without steps and synchronize with the centre-line of doors at BRTS Stations)	Confirm
A	Door aperture (without flaps) in mm	800mm each door	Confirm
B	Clear door width (fully opened)	≥650mm each door	Confirm
C	Door height	1900 mm (minimum)	Confirm
D	Number of gates minimum	2	Confirm
D	Fixed partition between gates – full height	Required	Confirm
	Width of partition in mm	400(maximum)	Confirm and provide width----mm
	Location of partitions between exit and entry gates on both sides.	Vertical centre line of the partition is centre line of wheel base– ref details at annexure 'A1' of Part II	
E	Positioning doors with respect to partition.	One on each side of partition	Confirm

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details	
S. No.	Description	Specifications	
		Midi buses	
F	Number of gates	2	Confirm
13.4	Maximum first step height (mm) from ground – unladen position in buses with:		
A	Stepped type entry on near side doors	400 mm	Confirm and indicate first step ht.----- mm
B	No step entry/level entry (at station platform height.)on driver side	900 ±10 mm	Confirm
13.5	Maximum height (mm) of other steps on near side gates	250 mm – In no case, bus floor height should go beyond the maximum floor height.	Confirm
A	Front door – ahead of fixed partition	250 mm	Confirm and provide dimensions ----mm
B	Rear door – behind partition	250 mm	
13.6	Ramp / suitable mechanism for wheel chair access at the near side gates,	Not required	1. Confirm 2. Type--- size---- 3. Dimensions 4. Material ---- specs---- 5. Load carrying capacity ----- kgs
A	Dimensions	As applicable for 14.8	
B	Material		
C	Load carrying capacity		
D	Device to prevent the wheel chair roll off the sides when the length exceeds 1200mm		Confirm
E	Device to lock wrapped up ramp		Confirm
F	Kneel ramp control: (deleted)		NA
G	Requirement for passenger with limited mobility	√	Confirm
I	Wheel chair anchoring – minimum for one wheel chair	√	Confirm
li	Priority seats – minimum 2 seats	√	Confirm
lii	Stop request- on pillars– selected for operational convenience	√	Confirm
H	Emergency doors/exits or apertures (numbers)	As per AIS 052	1. Confirm 2. Emergency door details----, type----, size-----, locations----
	Dimensions in mm	As per AIS 052	

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details	
S. No.	Description	Specifications	
		Midi buses	
		nos---	
I	Passenger safety system – allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory	Confirm and provide details of mechanism
J	Power operated service door – construction & control system of a power operated service door be such that a Passenger is unlikely to be injured/trapped between the doors while closing.	As per AIS 052	Confirm and provide details of mechanism
K	Door components	As per AIS 052	Confirm
L	Door locks/locking systems/door retention items	As per AIS 052	Confirm
M	Door hinges	As per AIS 052	Confirm
14	Bus body		
14.1	Design type approval	As per Annexure-3 of UBS II	Confirm and provide details
14.2	Bus structure – materials specifications etc	Material to be decided by the manufacturer. Other requirements as per bus body code. Material should fulfill strength etc. requirements indicated under Annexure-3 of UBS II and those in Part I above.	Details of Structural materials fulfilling strength etc. requirements indicated under Annexure-3 of UBS II and those in part I of specs to be provided as a separate annexure / drawing with complete dimensional, materials and other details of specs at bidding stage.
14.3	Insulation		
A	Roof structure/body	Material to be decided by the manufacturer. Other requirements as per bus body code. Material should fulfill strength etc. requirements indicated under Annexure-3 to UBS II and part I above.	Confirm material specs, density etc at bidding stage.
B	Battery pack compartment		Confirm material specs, density etc at bidding stage.
14.4	Aluminium extruded sections for:		
A	Rub rail	Aluminium extrusion IS 733/1983 or better	Confirm and provide details of specs, sizes, make etc at bidding stage.
B	Decorative moulding		
C	Wire cover		
D	Wearing strip		
E	Foot step edging		

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details
S. No.	Description	Specifications
		Midi buses
F	Panel beading	
G	Window frame	
H	Roof grab rail brackets	
14.5	Floor type / materials etc	
A	Type of floor	Uniform floor inside bus without steps
B	Steps on floor	No steps except for near side gates.
C	Maximum floor slope	As per AIS 052
D	Floor surface material	12mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513(Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000(IS15061:2002)
E	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy
14.6	Safety glasses and fittings:	
A	Front windscreen (laminated) glass:	Single piece laminated safety glass,plain,flat/curved with curved corners with PVB film IS 2553 (Part-2)-1992/latest.Standard designs for MIDI buses to be followed (Refer Annexure 1to UBS II)
	Size:	Standard designs for midi buses to be followed. (Refer Annexure 1 to UBS II)
B	Rear windscreen:	Single piece flat/curved toughened glass-plain/flat/curved at centre& curved at corners IS 2553(Part-2)–1992/latest
	Size:	Standard designs for midi buses to be followed. (Refer Annexure 1 to UBS II)
C	Side windows:	Flat, 2-piece design-top fixed toughened glass IS 2553 (Part-

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses 2)-1992/latest.	details
D	Glass specifications	Toughened glass IS2553(Part-2)-1992/latest	Confirm and provide dimensional and specs details at bidding stage.
	Glass thickness:	4.8-5.3mm	Confirm dimensions
E	Window & other glasses – material specifications, thickness etc	Toughened as per IS 2553(Part-2)–1992/latest of 4.8-5.3 mm thickness	Confirm and provide dimensional and specs details at bidding stage.
F	Safety glass	As per AIS 052/CMVR	Confirm and provide dimensional and specs details
G	Rear view mirrors	As per AIS 052	Confirm and provide dimensional and specs details
14.7	Seating and gangway etc		
14.7.1	Passenger seating for AC deluxetype-1 buses	As per AIS 052	Confirm
A	Seat layout	As per AIS 052	Confirm and provide dimensional details
B	Deleted		
C	Seat area/seat space per Passenger (width*depth) mm	400*350	Confirm and provide dimensional details
D	Seat pitch – minimum in mm	As per AIS 052	Confirm and provide dimensional details
E	Minimum backrest height-from floor to top of seat/headrest	As per AIS 052	Confirm and provide dimensional details
	Seat base height-distance from floor to horizontal front upper surface of seat cushion mm.	As per AIS 052	Confirm and provide dimensional details
	Seat back rest height in mm	375	Confirm dimensions
F	Torso angle (degrees)	Minimum 12°	Confirm
G	Seat materials	'PPLD/LDPE'moulded AIS:023 & bus code for performance	Confirm and provide dimensional and specs details
H	Seat frame structure material where required:	Frame Structure of ERW steel tube	Confirm and provide dimensional and specs details
I	Free height over seating position in mm	More than 800	Confirm dimensions
	Seat base height:	As per AIS 052	Confirm dimensions
J	Clearance space for seated Passenger facing partition mm	AIS 052	Confirm dimensions
K	Seat back/Pad	Not required.	

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details
S. No.	Description	Specifications
		Midi buses
	material/Thickness: (optional)	
	Type:	MDI moulded IS 5509
	Upholstery:	Not Required
L	Area for seated passengers (sq.mm.):	400*350
M	Area for standee passengers (sq.mm.):	As per AIS 052
N	Number of seats including one for wheel chair	23-26
O	Number of standees (calculation as per AIS 052)	As per AIS 052
P	Seats side facing location	Optional In this case seat belts provision as per AIS 052 / any other standard
Q	Seat back rest	Fixed
r	Seat belts & their anchorage	Not necessary except diver seat & wheel chair and those facing aisle (performance etc. as per AIS 052)
s	Performance & strength requirements of:	√
i	Driver seat	As per AIS 023
ii	Passenger seats	As per AIS 023
14.7.2	Gangway:	
a	Minimum interior head room (centre line of gangway) in mm	1900 mm including that in the rear overhang area.
i	At front axle:	As per AIS 052
ii	At rear axle:	
iii	Other areas	
b	Gangway Width (mm) from gates to longitudinal space between rows of seats (Access to service doors)	(Refer figure-1 of UBS II) minimum 600 mm
c	Gangway Width (mm) in longitudinal space between rows of seats	(Refer figure-1 in UBS II) minimum 600 mm excluding armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge.

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details	
S. No.	Description	Specifications	
		Midi buses	
D	Driver's working space	As per AIS 052	Confirm and provide dimensions
	Driver's seat	As per AIS 023 & AIS 052	Confirm and provide dimensional and specs details
14.8	Corrosion prevention & painting	As per clause 3.17 of AIS 052	Confirm
A	Corrosion prevention treatment	As per clause 3.17 of AIS 052	Confirm
	Internal surfaces of structural members		Confirm and provide process followed
	External surfaces of structural members		Confirm and provide process followed
	After drilling holes/welding		Confirm and provide process followed
	Inter metallic galvanic corrosion prevention		Confirm and provide process followed
B	Primer coating		Confirm and provide process followed and specs of primer coating used
C	Painting:		Confirm and provide process followed and specs of paint coating used
15	Electricals	Multiplexing provision for electrical circuitry	Confirm, type. Provide details and the drawings
15.1	Electrical cables mainly for bus ancillary systems:	BIS marked, copper conductors with fire retardant as per IS/ISO: 6722:2006 as per appropriate class. Conductor cross-section varying as per circuit requirements, minimum cross-section 0.5 sq mm. Quality marking may also be as per equivalent or better European, Japanese, US standards	Confirm and provide details of specs, sizes, make etc of each type of cable
15.2	Conductor cross section	As above and suitable to carry rated current (Japanese auto Standard JASO D0609-75 AV)	Confirm and provide details of specs, sizes, make etc of each type of cable
15.3	Safety requirements of electrical	As per AIS 052	Confirm
a	Fuse	As per AIS 052 – fuse of rated current 1.5 times the load current of electrical equipment.	Confirm and provide details of specs, sizes, make etc

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses	
		Necessary in every electrical circuit	
B	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	As per AIS 052- Isolation switch required for each such circuit	Confirm and provide details of specs, type, make etc
C	Location of cables away from heat sources	As per AIS 052- Required for each such circuit	Confirm
D	Type approval of circuit diagram as per standards related to electric equipments/wiring	As per AIS 052 – Required for all items	Confirm and provide details along with relevant certificates
E	Cable insulation with respect to heat	As per AIS 052	Confirm and provide details etc
F	Power supply cut – off switch (isolator switch):	Heavy-duty type capable of carrying & interrupting total circuit load.1 each near battery/driver	Confirm and provide details of specs, make etc
15.4	Wind screen wiper:	Electrically operated with two wiper arms & blades, wiper motor heavy duty steel body with minimum 2-Speed operation wiping system as per CMVR/BIS 7827 part-1, 2, 3(Sec.1 & 2)/latest. As per AIS 011	Confirm. Provide Make ----, model----, specs--- of wiper machines and its subsystems
A	Wiper motor:	Variable speed with time delay relay as per AIS11.	Confirm. Provide Make ----, model----, specs--- of wiper motor and its subsystems
B	Wiper arm/blade:	AIS 019/AIS011	As above wrt arms / blade
15.5	Driver cabin fan	1 number, 200mm fan as per provision of CMVR, matching interiors	Provide Make ----, model----, specs--- of fan
15.6	Lighting – internal & external and illumination	As per AIS 052.	Confirm and provide details of lighting / illumination
15.7	Illumination requirements/performance of:		
a	Dash Board Tell tale lighting/control lighting	As per AIS 052 & bulbs tested for photometry as per IS 1606:1996	Confirm and provide details of specs, wattage, make etc
B	Cabin Lighting – luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of ≥ 100 lux & ≤ 200 lux	Confirm and provide details of specs, wattage, make etc
C	Passenger area lighting – luminous flux of all lamps for Passenger	As per AIS 052 with illumination level of ≥ 100 lux and ≤ 150 lux	Confirm and provide details of specs, wattage, make etc

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)		Bidder to confirm and provide following details	
S. No.	Description	Specifications	
		Midi buses	
	area lighting		
16	ITS enabled bus	As specified separately under ITS chapter of UBS II specifications	
17	Safety related items:		
17.1	Driver seat belt & anchorage duly type approved.	ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS: 005&015.	Confirm and provide details of specs, type, make etc of seat belt and anchorage
17.2	Passengers seat belt: Number:	Not necessary except diver seat, for seats facing gangway in the last row if any.& wheel chair (performance etc. as per AIS 052)	
17.3	Driver/Passenger/wheel chair SeatBelt Anchorage		Confirm
17.4	Fire extinguisher:	As per AIS 052	Provide Make -----, model-----, specs--- of fire extinguishers
17.5	First aid box:	1 number, as per provision of CMVR	Provide Make -----, model-----, specs--- of first aid box and its contents.
17.6	Handrails Minimum length*diameter* height above floor in mm	Colour contrasting and slip resistant of aluminium tubing 32 mm dia, 3 mm thick.	Confirm and provide details of specs, sizes, make etc
17.7	Handholds:	Colour contrasting and slip resistant. 2 to 4 Numbers. Hand holds per bay out of poly-bicarbonate material and with provision for advertisements	Confirm and provide details of specs, sizes, make etc
17.8	Stanchions:	Vertically fitted, aluminium tubing with Colour contrasting and slip resistant. 40 mm dia & 3.15 mm thick. Rest As per AIS 052.	Confirm and provide details of specs, sizes, make etc
17.9	Bells for Passenger convenience	High visibility bell pushes shall be fitted at a suitable height (≥ 1.2 meter on all/ alternate/convenient stanchions keeping in view convenience of passengers and avoidance of un-necessary/ inadvertent operation by passengers. These would assist PwDs	Confirm and provide details of specs, sizes, make etc
17.10	Left blank		
17.11	Window Guardrails:	As per AIS 052.	Confirm and provide details of specs, sizes, make etc where provided
a	In all school buses – minimum numbers.		
B	In all other buses – minimum numbers.		
C	In AC super deluxe buses		

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses	
d	Other details:		
i	First guard rail at a height from window sill in mm		
ii	The distance between two guard rails in mm		
17.12	Entrance/Exit Guard/Step well guard:	800 mm minimum height extending ≥ 100 mm more than centre line of sitting position of the Passenger.	Confirm and provide details of specs, sizes, etc
17.13	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR	Confirm and provide details of specs, make etc
17.14	Front/rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008	Confirm and provide details of specs, wattage, make etc
17.15	Mirrors right/left side exterior/interior:	Convex as per AIS 001 & 002. Interior with double curvature	Provide Make -----, model-----, specs--- of rear view mirrors
17.16	Towing device front and rear	Heavy duty for loads of 1.2 times (minimum) the kerb weight of the bus within 30° of the longitudinal axis of the bus. As per CMVR & IS 9760 – ring type	Confirm and provide dimensional and specs details
17.17	Warning triangle	As per AIS 052/CMVR	Provide Make -----, model-----, specs--- of warning triangle
17.18	Fog Lighting	As per AIS 052/CMVR	Confirm and provide details of specs, wattage, make etc
17.19	Bumpers – front and rear	Both made of Steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system	Confirm and provide details of specs, sizes, make etc
	Impact strength for bumpers	Meet requirements of Para 6.3.1 of AIS 052	Confirm and provide details of impact strength etc Para 6.3.1 of AIS 052 does not give any values, test standard and or test procedure. VM would hence be required to provide above details at the time of pre-bid meeting.
18	Miscellaneous items/requirements		
18.1	Windows		
A	Type of window	Fixed windows	Confirm and provide details of specs, sizes, make etc

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications Midi buses	
B	Minimum height of window aperture (clear vision) ²	≥ 950 mm	Confirm and provide dimensions
C	Minimum height of upper edge of window aperture from bus floor	As per AIS 052	Confirm and provide dimensions
D	Minimum width of windows (clear vision zone)	As per AIS 052	Confirm and provide dimensions
18.2	Cabin luggage carrier	Not required	
18.3	Life cycle requirements of bus (whichever is earlier)	10 years or 8,00,000 km	Confirm and provide details of mechanism of assessing life of buses
19	Air conditioning system – test procedure for type approval		
19.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature	Provide details as under: i. Heat loss / heat load in terms of KWs, from total bus system. ii. Air conditioner size and capacity requirements iii. Electric propulsion system power requirements conditioning system. iv. Total power consumption for 12 hrs. of operation at 23° C under continuous operation of vehicle with bus operating at design loads, etc. v. Type, size, make , model, capacity of the compressor, condenser, evaporator etc , vi. Type of insulation provided in the bus along with the details thereof, vii. Ducting layout for uniform circulation of cool air viii. Ventilation and air circulation system for cooling ix. Tools / system of objective measurement of temperature x. Rate of cooling and time required for obtaining target results when out- side temperature is 45°C and the saloon temperature is 23°C xi. Type of air curtains at entry exit gates, space requirements, power consumption, etc xii. Similar details for heating system,
19.2	Target results	a) 24± 4°C (Up to 42°C) b) Temperature Gradient of 15°C (> 42°C of saloon temperature) e.g. If the saloon temperature is 45°, then the target temperature inside the bus is 45°-15°= 30° c) Min avg. air velocity at air vent is 4.5 m/s	a. Confirm and provide details of temperature range provided. b. Confirm and provide details of temperature range provided c. Confirm and provide average

²Clear vision includes partition between fixed and sliding glass if any subject to a maximum width of 100 mm

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses	
			air velocity at air vent
19.3	Apparatus	Lab condition and heating chamber	Confirm and provide details
19.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3. Upto 42°C: pull down time 30 minutes (maximum)(for more than 42°C of saloon temperature, pull down time within 40 min (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers. At nose level	Confirm and provide details against each head.
20	Additional requirements		
20.1	Air circulations and ventilation in driver's area	An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab	Confirm and provide dimensions / location
		Drivers work area to be provided with blower or suitable device (200 mm diameter fan) to ensure proper ventilation. These devices may be capable of 3 – speed adjustment	Confirm and provide details of make, model and rating of fan.
20.2	Maximum noise levels inside the saloon (irrespective of AC, non-AC/Electric propulsion system location)-test procedure as per AIS 020	81dba	Confirm and provide details
21	Fire Detection and Alarm System (FDAS)	An automatic fire detection & alarm system be essentially provided for the fire prone areas and other fire sensitive areas of the bus. Possibility of provision of FDAS for entire bus including but not limited to electric propulsion system area, drive line, battery pack, battery charging point and power distribution lines / cluster, wheel wells, electrical systems etc.	FDAS provided for: - Name all systems, sub-subsystems; Indicate type, make & model of provisions in each case.
A	Fire Condition Monitoring device	Pneumatic Electronic Linear fire detector with stainless steel tube with suitable diameter	Make and model of the fire detector; Dia and specs of SS tubing;
B	Components for Fire Condition Monitoring Device		

BRT Midi buses (AC) - Specifications – Ahmadabad Janmarg Ltd (AJL)			Bidder to confirm and provide following details
S. No.	Description	Specifications	
		Midi buses	
I	Generally as per UBS II, AIS 135, CMVR	Detector operating on rate of rise with Advanced Built in Test Module.	Make, model & specs;
II		Stainless steel Tube sensor with suitable diameter and should be rodent free	Specifications and relevant documents be provided
C	Detector Specification/ requirements: Generally as per UBS II, AIS 135, CMVR (if any)	Detector should operate with Rate of Rise along with advanced Built-in Test Module that indicates failure in the event of reduced performance over the entire range of sensor tube.	
I	IP Rating	IP67	
II	Enclosure	Aluminium	
III	Operational Temperature Range	-40°C to +125°C	
IV	Shock & Vibration:	Should comply to BS EN 61373, Table 1,2,3 MIL STD- 810:501.4, 516.5.4.	
V	Sensor Tube	1 Mtr to 100 Mtr in length. Stainless steel material with suitable diameter.	
VI	Operating Voltage:	18 - 32 V DC	
VII	Alarm Current:	40mA	

Notes:

1. All cross and or T or X-joints of structural elements of bus body structure (Front, rear, sides, roof, floor, etc) be provided with MS gussets of min 2.5mm thickness. All Weldments / structural sub elements be properly cleaned and treated for corrosion prevention
2. Service / inspection hatches with covers be provided for servicing of various aggregates / sub-systems of bus.
3. Width of wheel arches frame be maintained as per chassis manufacturer specs for providing adequate ventilation to tyres amongst fulfilling other needs.
4. Stanchion pipes and grab rails to be of Aluminum tubing of appropriate specs, size / wall thickness etc. Handholds supporting hand rails and the stanchion pipes be painted in cannery yellow color, Brackets be grey matching the colour of the inner paneling. Brackets however need to be of proper size and shape to ensure perfect fittings. No redundant fastening holes be provided on brackets
5. Hand holds be of polycarbonate material, transparent and provision for space for advertisements
6. No Spare-wheel carrier and spare-wheel hatch need be provided on the bus. As the same need not be carried on-board during urban operations. Spare wheel would be retained in bus depot as float.
7. Stop buzzers may be provided as one in frontal area, one in middle and one in the rear area on stanchions at reasonable height ensuring easy accessibility as well as preventing

unnecessary usage. Design of buzzer switch be sturdy, long lasting and sunk-in type to avoid undesirable / inadvertent operation.

8. LED illumination provided in saloon area of the bus be covered with ground glasses to prevent glare.
9. Mounting of bus body cross bearers on chassis be as per design / instructions of the chassis manufacturer.
10. Tail lamps be covered with metallic grill in a manner that not only protects the tail lamps but also facilitates lamp replacement etc.
11. Front and rear facia of the bus body may be fabricated out of FRP suitably designed, ensuring its strength, finish and ease of repair / replacements at par or better than the metallic ones asked for in the specs.
12. Where type approval, of any of the bus body items including full bus body / bus is a mandatory requirement Type approval be undertaken by test agencies authorized under CMVR. In other cases approval of selection of testing agency be obtained from AJL.
13. Design approval of multiplexing wiring in bus body / bus be obtained from test agencies authorised under CMVR or any other agency accredited for the purpose subject to approval of AJL.

Bus body builder to provide detailed drawings / specifications / make / model etc as called for in specs for all items as generally indicated in RFP specs. Including but not limited to electrical Circuit diagrams of electrical subsystems in the bus.

Appendix 'A' to part II above –Passenger entry / exit gates, doors size and locations – Midi bus for AJL

Fig 1: Passenger entry / exit doors size and locations for provision in BS-IV Compliant Electrically propelled 9200±200mm Long AC Midi Buses for Ahmedabad BRTS.

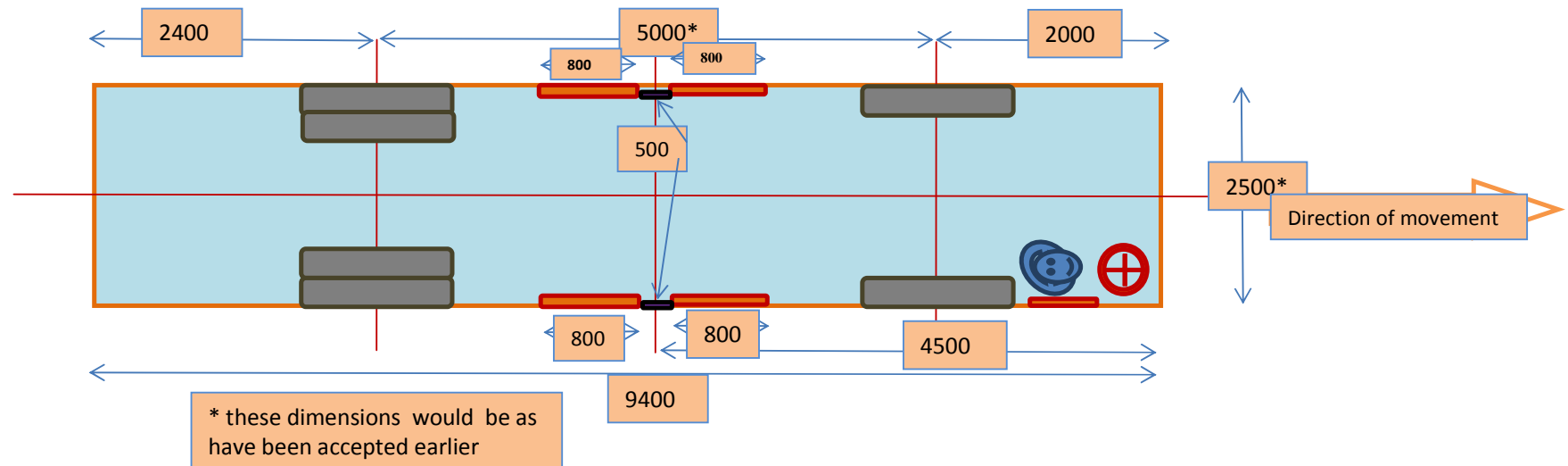


Fig 2: Layout with passenger circulation plan and specifications for steps

