Technical Specifications of HVAC Ordinary Bus

PUNJAB
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Rule TECHNICAL-SPECIFICATIONS-OF-HVAC-ORDINARY-BUS of 2007

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Technical Specifications of HVAC Ordinary BusPublished vide Notification No. 7/3/07-IT2/8830, dated 8th November, 2007Last Updated 22nd May, 2019Department of Transport(Transport-II Branch)No. 7/3/07-IT2/8830. - In exercise of the powers conferred by proviso to Rule 130 of the Punjab Motor Vehicles Rules, 1989 and all other powers enabling him in this behalf, the Governor of Punjab is pleased to specify the following technical specifications of HVAC ordinary bus :-

1.

0. Scope.

- 1.1 The specification covers the design and manufacture of new HVAC buses for operation in Punjab and inter-state routes. The bus design shall be energy efficient, environment friendly, safe and secured for transportation of passengers besides the following main attributes amongst others :-(i)Passenger comfort(ii)Ergonomically designed driver's work area(iii)Ease of repair and maintenance(iv)Aesthetically designed interiors and exteriors(v)Ease of boarding and alighting for all passengers(vi)Ease of accessibility to persons with disabilities(vii)Fit for the operation of HVAC system.1.2.1The bus shall comply with all applicable Central, State and Local Laws (including Acts, Rules & Regulations). These shall include, but not be limited to, the Persons with Disability Act, 1995 as well as State and local accessibility, safety and security requirements.1.2.2The word "Bus" wherever it has been used in the specification means the "New HVAC bus". The bus shall meet all applicable Central Motor Vehicles Rules (CMVR) of India and Govt. Safety, Emission & other norms applicable on the date of manufacture.1.2.3Where there is conflict between the requirement as per any applicable law in force and the requirement emanating from these specification whichever of these two is of superior/higher standard shall prevail. 2.0General Design Features.- 2.1 The full forward control bus shall have right hand drive and to be fitted with engine at the rear or front of the bus. The bus shall be designed and manufactured in accordance with the specifications of Code of Practice for Bus Body Design and Approval' (AIS 052), hereinafter referred to as Bus Code

applicable to buses in INDIA or CMVR whichever is superior. The bus shall be designed to carry commuters with ease of boarding and alighting especially for ladies, senior citizens and persons with Disabilities. The bus design shall be suitable for daily operation of 16 to 20 hours with peak loading of over 72 passengers (@68+7 Kgs each), average travelling speed of about 50 Kms per hour with starts/stops after every 15 minutes.2.2The bus design shall be eco-friendly, energy efficient, safe and comfortable with exhaust emissions maintained at specified levels (Bharat Stage II or Euro-III subject to meeting additional requirement, if any of Bharat Stage-III or any further standard as imposed by law and further improved standard as applicable on the date of manufacture).2.3The bus must be of proven design suitably modified to the climatic and operational conditions, infrastructure and road conditions in Punjab.2.4The material used in the construction of buses shall be as per Bureau of Indian Standards (BIS)/Automotive Industry Standards (AIS) specifications and/or other international specifications meeting/surpassing the performance and 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/indicated. Specification standards wherever indicated in the Technical Specification shall be conforming to the Specification Standards as amended up to date/or latest. Wherever the specifications of any item have not been notified as International/National Standard etc. the manufacturers/bus body builders shall provide the actual specifications of that item along with the drawings of the items indicating all relevant details.2.5BIS Standards are available from Bureau of Indian Standard, Manak Bhawan, 9-Bahadur Shah Zafar Marg, New Delhi-110 002 Web site: http:*www.bis.org.in. Similary AIS Standards are available from Automotive Research Association of India. Post Box No. 832, and Pune-411 004. Website: http:* www araiindia.com. ASRTU Specifications are available from Association of State Road Transport Undertakings, 7/6, Sirifort Institutional Area, August Kranti Marg, New Delhi-110049. Website http://www.asrtu.org.2.6Suitable traps/openings with appropriate sealing shall be provided for repair and maintenance of various aggregate/systems/sub-systems of the bus.2.7Any other provisions/fitments required for safe and efficient operation and or for fulfilling statutory requirements be provided in the offered bus.2.8The bus shall be so designed to maintain operational stability requirement as per Bus Code. Interior noise and pass by noise of the vehicle shall conform to BIS: 12832-1989 or latest and BISL.3028L1998, 10399L 1998 or latest respectively.2.9Safety Items : Special hammer with pointed noise and back of handle tied with flexible cable should be mounted on Window Pillars. Total 7 hammers be provided, three on each side and one at the rear. Instruction Sticker in Punjabi and English should be pasted near each Hammer.2.10The Roof hatch should be openable from inside as escape route in case of Emergency.

3. Engine.

- 3.1 The engine system shall have adequate horse power to obtain desired performance in respect of its adequacy of power, acceleration levels, emission norms, specific fuel consumption etc. The engine should have adequate horse power not only to propel the bus but also to operate efficiently all other auxiliary devices including HVAC system fitted to the bus. The minimum Horse Power of the Engine to propel bus and to directly operate HVAC system should not be less than 160 HP.3.2Engine should be able to operate efficiently at ambient temperatures of approximately 0 to 50 C, humidity level from 5% to 100% and altitude up to 300 metres on plain areas and maximum

up to 3000 metres on the hill areas.3.3The engine and its accessories shall be easily replaceable. The engine mounting shall be such as to minimize transmission of vibrations to the bus structure. The engine foundation and mounting shall be so located as to facilitate easy accessibility and replacement. Engine design shall be such that it shall not be overheated during normal operating conditions of vehicle. An arrangement for audio-visual signal shall be provided in the event of engine getting overheated excessively. This arrangement shall indicate the temperature at which the signal operates. Similar arrangement for other sub- system of engine with their monitorable indicators be made on the dashboard.3.4The engine compartment shall be insulated to avoid transmission of heat and noise to saloon area. The passenger and engine compartments shall be separated by bulkhead(s) that shall by incorporation of fire proof material preferably of ceramic fibre of minimum density of 128 Kgs/M3 in its construction, be a firewall. The engine compartment shall include areas where the engine and exhaust systems are housed including the muffler, if mounted above the horizontal shelf. This firewall shall preclude or retard propagation of an engine compartment fire into the passenger compartment. Only necessary opening shall be allowed in the firewall, and these shall be fireproofed. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent to retard fire propagation through the firewall. Engine access panels in the firewall shall be fabricated of fireproof material and secured with fireproof fasteners. These panels, their fasteners and the firewall shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the firewall.3.5The engine should be suitably designed to operate optimally under peak summer heat and dust. Suitable lighting arrangement with separate switch shall be provided for the engine compartment.3.6Engine noise and emission levels must confirm to the Central Motor Vehicle Rules, 1989.3.7For soundproofing and for protection against fire risk in engine compartment, no flammable material or material liable to soak fuel, lubricant or any combustible material shall be used in the engine compartment unless the material is clad by an impermeable fireproof sheet. A partition of heat-resistant material shall be fitted between the engine compartment and any other source of heat.3.8In case of rear engine vehicle shall have air intake location in a manner as to provide dust free, restriction-free adequate quantity of air so as to avoid any operational problem of the engine.3.9A mechanism in the engine compartment shall be provided to prevent start of the engine from the driver's seat while maintenance is being carried out near the engine compartment area.3.10Exhaust gases and waste heat shall be discharged from the rear corner of the driver side. The entire exhaust system shall be adequately shielded to prevent heat damage to any bus component. The exhaust outlet shall be designed to minimize rain or water generated from high-pressure washing system from entering into the exhaust pipe and causing damage to the catalyst.4.0(A)HVAC System .- 4.1 The bus shall have heating, ventilation and air-conditioning system of appropriate size, type and capacity as prescribed under Para 4.9 and as per the operating/environmental conditions given at Para 2.3 and 3.2 for carrying up to 72 passengers. The nominal temperature of 23 to 25 degree centigrade must be achieved in the saloon before boarding of the passengers.4.2The HVAC bus installed in the bus should allow intake of minimum 10% fresh air.4.3The bus shall be provided with roof mounted HVAC system driven by main engine comforming to Indian/International standards. The system shall be so mounted to facilitate ease of access for repair and maintenance. Proper care shall be taken for insulating the system for optimum efficiency. Proper AC ducting shall be installed inside saloon for uniform distribution of air conditioned flow. Air-conditioning system shall be CFC free.4.4The HVAC system must be so

designed to work in compatibility with other vehicle systems. The Air-conditioning system shall have large heavy-duty transit compressor and high capacity alternator. A properly sized alternator/charging system shall be selected to support the Air-conditioning system and to improve reliability and efficiency of the system. The system shall be designed to meet any future regulations on refrigerant etc.4.5Automatic temperature control arrangement shall be provided for HVAC system.4.6The HVAC system shall be at center of the passenger saloon of the bus and mounted aesthetically at the roof.4.7The drivers cab shall be fitted with a 24 VDC, 200mm dia. fan mounted at proper height on side structure. The colour of fan shall match the interior decor of the bus. A high output two speed demister shall also be fitted in the driver's cabin to draw fresh air from roof.4.8The whole bus body shall be fully thermally insulated with flame retardant Polyurethane or glass wool of minimum 40 Kgs/m3 density as per bus code.4.9The HVAC system installed in the bus shall have minimum capacity as under :-

(i)	Up to 45 seater bus	10 ton capacity
(ii)	From above 45 seater to max 60 seater	12 ton capacity
(iii)	More than above 60 seater	14 ton capacity

4.10The HVAC system installed in the bus shall be of Thermo King, Carrier, Spheros, Haiger, Denso or of any other make approved by STC, Punjab.4.0(B)Cooling System.- Heavy duty radiator and other subsystems of cooling system shall be so designed as to be capable of efficiently dissipating heat from the engine system. Deaeration tank and pressurized radiator cap shall be provided. It shall be easy for filling and level checking of coolant. Replacement/maintenance of radiator and its items be also easily carried out.5.0Transmission System .- 5.1 Multi speed manual transmission system shall be provided with gross input power, gross input torque and related speed compatible with engine.6.0Suspension.- 6.1 The bus shall be fitted with leaf suspension (or beveller suspension or air bellow suspension as optional) at both front and rear. However in case of air suspension, the suspension system shall be fitted with shock absorbers, suitable for trouble free operation and jerk free comfortable ride and should be adequately protected from engine/exhaust pipe heat etc. for minimizing ageing effect on the air bellows.6.2The full air suspension system both at front and rear shall be with stabilizer bar.7.0Steering.- Hydraulic power assisted recirculation ball type steering shall be provided.8.0Braking System .- 8.1 The braking system shall be full pneumatic type with fail-safe dual circuit having four-way protection valve, auto slack adjuster, drum brake (front and rear wheels) with asbestos brake lining etc. The friction material shall be non-asbestos type having temperature and wear characteristic suitable for intensive operation. Brake squeal shall be absent under normal conditions of operation. An air compressor which minimizes oil carry over shall be fitted. The braking system shall be fitted with air dryer and oil/ water separator system. The buses shall also be provided with hand operated pneumatic flick valve type parking brakes at rear wheels. The air pressure line shall be treated for corrosion resistance.8.2In the event of failure of the engine and or loss of air in the system, adequate provision is made for obtaining effectiveness of service brake system and or for deactivating the spring actuated brakes. 8.3The Anti-skid/Anti-lock braking system (ABS) shall be provided. 9.0Wheel and Tyres.- 9.1 The bus shall be fitted with steel radial tyres conforming to AIS-044 Part I with wheel rims of corresponding size conforming to AIS/BISL 10694 (Part-3)-1991 or latest. The bus shall be supplied with 6 sets of tyres (two on front and four on rear wheels) fitted on the bus plus one set as spare Steppney. The tyre shall be fresh from factories and shall not be more than six months old at the time of

delivery.9.2It shall be possible to safely jack up the bus, at kerb weight, with a capacity of at least 10 Ton (as per design of the bus) jack with or without special adapter, when a tyre of dual set is completely flat and the bus is on a level, hard surface, without crawling under any portion of the bus, jacking from a single point shall permit raising the bus sufficiently high to remove and reinstall a wheel and tyre assembly. Jacking pads located on the axle or suspension near the wheels shall permit easy and safe jacking with the flat tyre or dual set on a 150mm high run-up block not wider than a single tyre. The bus shall withstanding such jacking at any one or any combination of wheel location without pemanent deformation or damage. Jacking pads shall be painted safety yellow or orange for ease of identification.9.3Suitable guards be provided near wheel to prevent damage/for obtaining safety from stones hurled from tyres.9.4The bus axles or jacking plates shall accommodate the lifting pads of a 4 post hoist system. Jacking plates, if used as hoisting pads, shall be designed to prevent the bus from falling off the hoist. Other pads or the bus structure shall support the bus on jack stands independent of the hoist.9.5Splash aprons of minimum 6.50 mm thickness composed of rubberized fabric shall be installed behind of wheels as needed to reduce road splash and protect under floor components. The splash aprons shall extend downward to within 100 mm of the road surface at static conditions. Apron width shall be no less than tyre width, except for the front apron, which shall extend across the width of the bus. Splash aprons shall be bolted to the bus under structure. Splash aprons and their attachments shall be inherently weaker than the structure to which they are attached. The flexible portions of the splash aprons shall not be included in the road clearance measurements. Other splash aprons shall be installed where necessary to protect bus equipment.10.0Axles.- 10.1 Solid beam axle and grease type front bearings and seals of reliable and proven design adequate capacity to take care of maximum Gross Vehicle Weight (GVW) and crush loading expected during life span of the bus.10.2The bus shall be driven by a single heavy-duty axle at the rear of proven design adequate capacity to take care of maximum GVW and crush loading expected during life span of the bus. Transfer of gear noise to the bus interior shall be minimized. The lubricant drain plug shall be magnetic type, external hex head. If a planetary gear design is employed, the oil level in the planetary gears shall be easily checked through the plug or sight gauge. The drive shaft shall be guarded to prevent it striking the floor of he coach or the ground in the event of a tube or universal joint failure.11.0Under frame and Structure.- 11.1 The under frame and super structure shall be suitably designed to carry dense crush load of over 72 passengers (assuming an average weight of 68 kg per passenger) including sitting and standees, the super structure using steel tubing, bus tare weight etc. Moreover the structure shall be designed to withstand the transit service condition of operation throughout its service life.11.2The comprehensive multi-stage anti-rust treatment shall be provided to bus flooring, sides roof, under structure, axle suspension components etc. for resistance corrosion or deterioration from atmospheric conditions and road salts so as to enable them and frame to last for life span of bus whichever is latest. The samples of all material and connections shall withstand a two weeks (336 hours) Self Spray test in accordance with ASTM procedure B 117 with no structural detrimental effect to normally visible surfaces and/no weight loss of over 1%.11.3The front and rear structure design shall be energy absorption type to reduce impact stresses into under frame/side structures/other areas of the vehicle. The damaged area of the vehicle shall be easily repairable and/or replaceable in the event of major damage.11.4The entire surface of bus under floor and sides exposed to ground shall be covered with appropriate corrosion prevention and flame retardant paint coating for protection against harmful effects of water, mud etc. and to retard flames, if any. The wheel housings shall be constructed to

contain tyre bursts during operation and be flame retardant in case of tyre fire.11.5MIG welding shall be used for steel structural member's fabrication.11.6Sufficient clearance and air circulation shall be provided around the tyres, wheels and brakes to preclude over heating when the bus is operating.11.7All the structural members shall be MIG welded with suitable gussets/brackets of adequate size and thickness be provided on floor, side, front, rear and roof structure to ensure structure rigidity and integrity.11.8After anti-corrosive treatment, structural members shall be coated with Red Oxide/Zinc Chromate primer and superior quality black paint.11.9Under floor to sidewalls shall be sealed to prevent dust ingress.12.0Panelling.- 12.1 The bus exterior side panels shall be fitted with stretched steel sheet at waist level. The exterior front-end, panelling shall be of steels roof, rear and skirt paneling shall be of alumnium. Roof, exterior paneling shall be suitably provided with platforms for movement of technicians for repair and maintenance of roof mounting systems to avoid direct load on roof alumnium panelling. The platform shall be fitted to roof structure with proper reinforcement. All interior paneling shall be Acrylonitrile Butadiene Styrene (ABS) conforming to relevant National or International Standards. Wherever alumnium is joined with steel or with any dissimilar metals together, the involved joints shall be treated with thick layer of approved quality dielectric paint conforming to relevant Indian standards, before assembly. Adequate treatment be also provided to avoid any incidence of galvanic corrosion between dissimilar metals. Panels shall be so mounted as to present smart aesthetic exteriors.12.2All skirt panels below stretch panel line must be no long than 1500 mm. The said skirt shall be able to withstand the side impact as per the provisions of BIS: 14682-1999 or latest. Similarly the rear end shall be able to withstand the rear impact as per the provisions of B 18: 14812-2000 or latest.12.3Anti-drumming compound shall be applied on inner side (enclosed surfaces) of entire paneling.12.4Roof structure shall be thermally insulated with flame retardant polyurethane or glass wool of minimum 40 kgs/m density.12.5TIG welding for fabrication of aluminium components shall be used.12.6Rain gutters shall be provided to prevent water flowing from the roof on to the passenger doors, driver's side window; and exterior mirrors. When the bus is decelerated, the gutters shall not drain onto the windshield, or driver's side window, or into the door boarding area. Cross sections of the gutters shall be adequate for proper operation.12.7Entire front end of the bus shall be sealed to prevent debris accumulation behind the dash and to prevent drive's feet kicking or fouling wiring and other equipments. Front end shall be free of protrusions that are hazardous to passengers standing or walking in front of the bus during rapid acceleration.12.8Interior panels shall be attached so that there are no exposed unfinished or rough edges or rough surfaces. Panels and fasteners shall not be easily removable by passengers.13.0Paints.- 13.1 All the structural members of the bus shall be treated for corrosion prevention internally as well as externally and painted wherever required. The polyurethane (PU) painting conforming to 818: 1321-1991 or latest international standards as applicable shall be used for exteriors painting of the bus including interiors. Wherever required Color shade shall match to the shades as per BIS:' 5-1978 or latest.13.2All exterior surfaces shall be smooth and free of wrinkles and dents. Exterior surface to be painted shall be as required by the paint system supplier, prior to application of paint to assure a proper boner between the basic surface and succession coat of original paint for the service life of the bus. Paint shall be applied smoothly and evenly with the finished surface free of dirt and the following other imperfections :A. Blisters of bubbles appearing in the topcoat film.B. Chips, scratches or gauges of the surface finish.C. Cracks in the paint film.D. Craters where paint failed to cover due to surface contamination. E. Overspray.F. Peeling.G Run or sags from excessive flow and

failure to adhere uniformly to the surface.H. Chemical stains and water spots.14.0Service doors.- 14.1 One service door (To be used as both Entrance and Exit) in minimum 900 mm wide aperture (without flaps) to be fitted at front of the bus or two separate doors (one at front for exit and another at rear for entrance) with minimum 750 mm wide aperture must be as per provisions of the Bus Code. The door system shall be electropneumatically controlled by the driver and/or the conductor with internal and external emergency open controls. In the event of an emergency, it shall be possible to open the door manually from inside the bus by using a force no more than about 10 Kg after actuating and unlocking device. The unlocking devices shall be clearly marked as an emergency device and shall require two distinct actions to actuate. Door, door hinges and locks shall comply with safety requirements as per Indian/International standards. The closing and opening time of the door should be in the range of 4 seconds. There shall be maximum opening area in longitudinally and vertically directions in fully open condition. The door hinges and brackets shall be maintenance free. A pilot lamp on the driver's dashboard shall be provided to warn that the door is `Open' or not fully closed.14.2The door shall be of double jack knife type and shall be provided with suitable support in the form of grab handles, for boarding/alighting passengers on JK door flaps. Electronic sensors shall be installed at door to retract the door automatically if any obstruction to door occurs during door closing. It must be effective until door is fully closed.14.3A suitable device to prevent the door from opening as long as the bus is in motion shall be provided.14.4Service Door operation shall be controlled with the help of push buttons and switch.14.5All buttons and switches shall be labelled on a panel to the right side of driver.14.6Access door shall be provided with heavy duty sealing to avoid ingress of dust into the passenger compartment. The upper and lower section of door shall be glassed for no less than 45% of the door opening area of each Section. The glazing material and glass in the door shall be the same as in the side windows.14.7Door shall be fitted with heavy duty hinges as per bus code.14.8Door shall be fitted with heavy duty locks with and without lock and key depending upon their use. Striker plate shall be fitted at the closing end of locks.14.9All the handles shall match to the decor of its fitment location or shall be chrome plated.14.10Door shall open or close completely in no more than 4 seconds from the time of control actuation and shall be subject to the closing force requirements and the adjustment requirements. The door shall remain in commanded state position even if power is removed or lost. Operation of and power to the passenger door shall be completely controlled by the driver. A control or valve in the driver's compartment shall shut off of the power to, and/or dump the power from, the front door mechanism or both front and rear door mechanism to permit manual operation with the bus shut down.15.0Guard/Guard rails.- Where seated passengers are likely to be thrown into service door area as a result of heavy braking suitable guard shall be provided. The guard height shall be minimum 800 mm from the floor, and the guard shall extend inward from the wall at least 100 mm more than the centre line of the seating position of the passengers who are prone to. The suitable guardrails shall also be provided on front wheel boxes over suspension system. The guarding shall be as per the provisions of the Bus Code.16.0Windows.- 16.1 The windows shall be in single piece fixed glass type design. "The toughened glass wherever used in the body shall be 8 mm to 10 mm thickness and shall be light tinted. The window glasses'shall be fitted/pasted aesthetically. The size and shape of the glasses shall enable the passengers to have maximum outside view. The general requirements of window shall be as per the provisions of bus code.16.2Windows shall have provision of suitable sealing to avoid ingress of dust and water and shall have proper efficient drainage system.17.0Emergency Exit.- Emergency exits shall be provided in the bus as per the provisions of

the Bus Code/CMVR.18.0Escape hatch.- In addition to emergency exits, at least one escape hatch be fitted in the roof as per the bus code.19.0Floor.- 19.1 Internal saloon height shall be minimum of 1900 mm.19.2The flooring design should allow easy cleaning including that sweeping and drainage of water.19.3The floor shall be fitted with fire retardant marine board of 19 mm thickness conforming to BIS 710-1976 or latest and shall be fire retardant as per BIS 5509-2000 or latest. The said floor shall be coveted with anti-skid type with silicon particles material of minimum 3mm thickness meeting Indian/International standards. Adequate sealing shall be provided in the floor to prevent ingress of dust, gases, water, etc.20.0Gangways.- The gangway shall be as per the provisions of the Bus Code and would meet the statutory requirements.21.0Handrails and Handholds.- The Handrails and Handholds shall be provided as per the provision of bus code. The surface of handrails and handholds shall be of colour contrasting and slip-resistant. All handrails shall 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 shall be provided so that every standee passenger even during crush load, is able to grab a handhold.22.0Stanchions.- 22.1 Vertical stanchions shall be so positioned to facilitate access to seats for those standing. The stanchions shall be of 40.0 mm dia and 3.15 mm thick aluminium tubing with surface of colour constrasting and slip resistant.22.2High visibility bell pushes shall be fitted at a height of 1.2 metres on all alternate stanchions.23.0Passenger Seats.- 23.1 The passenger seats shall be front facing, comfortable, durable and maintenance free and of `PP-LD' (Polypropylene Low Density) moulded construction meeting the performance requirements of AIS023 and other requirements as per the Bus Code. The PP-LD moulded seat shall be appropriately fitted with flame retardant Polyurethane (PU) seat cushion of 25 mm thickness upholstering in waterproof expanded vinyl coated fabric to match the seat and interior decor conforming to relevant BIS/International standards. The seat cushion shall be provided with vent holes appropriately. Similarly, PP-I D moulded seat backrest shall be appropriately fitted with flame retardant Polyurethane (PU) backrest cushion of 10 mm thickness upholstered in waterproof expanded vinyl coated fabric. Suitable integral type seat hand grab rails shall be provided one on top of backrest and one at the back of backrest for seated passengers. However, the seat pitch shall be maintained at 686 mm (minimum).23.2The seats shall be covered with water and dust proof flame retardant upholstery. The construction of the seat shall be of easy replaceable and repairable.24.0Seat Belts and its anchorages.- Seat belts shall be provided for the seats as per the provisions of CMVR and the Bus Code. In case of six seats provided at the rear end of the bus, the two seats in the centre (facing the gangway) be provided with seat belts. Seat belts and its anchorages shall conform to the requirements of AIS 005 and AIS 015.25.0Driver's work area.- A driver door of not less than 1600 mm height and 650 mm wide shall be provided for entry and exit to driver's work area. Proper handholds and steps shall be provided for easy access to driver's cabin. All other requirements of driver's work area shall be as per the provisions of the Bus Code. The driver's work area shall have a light to provide general illumination and it shall illuminate the half of the steering wheel nearest the driver. Brake Pedal Angle shall be determined from a horizontal plane regardless of the slope of the cab floor. The brake pedal shall be positioned at an angle of 27-35 degrees at the point of initiation of contact and extend downward to an angle of 20-28 degrees at full depression. Brake pedal shall be 254-305 mm long and 75-100 mm wide. The driver's entrance-cum-exit doors shall be provided as per Bus Code with a provision of maximum width of sliding window using the material like glazing and glass as used in the other side window glasses.

The driver cab shall be fitted with a 24 V DC; 200 mm dia fan mounted at proper height on side structure. The color of fan shall match the interior decor of the bus.25.1Driver's seat : Driver's seat shall meet the requirements of AIS 023.25.2Driver partition : Driver partition shall be provided as per the Bus Code.25.3A barrier of bulkhead between the driver and the front passenger seat shall be provided. The barrier shall minimize the glare and reflection in the windscreen directly. In front of the barrier from interior light during night operation.26.0Dashboard Instrumentation and Control System.- 26.1 The bus shall have dashboard with full instrumentation panel containing meters and gauges to indicate important parameters like air pressure, coolant temperature, battery charging current, fuel level, side indicators, head lights, hand brakes, engine oil pressure etc. In addition warning lights for low engine oil pressure, high cooling system temperature and low coolant level, low pressure and high temperature of transmission oil, low fuel level, low air pressure and battery weak shall be provided at the driver's dash board. All the dashboard controls and instrumentation system shall be as per the bus code.26.2Rear-view Mirrors-Interior and Exterior. - Rear-view mirrors shall be provided on both sides of the bus to enable driver to have clear side/rear views. One interior rear-view mirror shall also be fitted for viewing saloon area by the driver. Installation and performance requirements of the rear-view mirrors shall conform to AIS 001 and AIS 002. The exterior rear-view minors shall also enable the driver to view the object near the bumper area.26.3Sun Visor. - 26.3.1 Adjustable sun visors shall be provided for the windshield and the driver's side window Visors shall be shaped to minimize light leakage between the visors and windshield. Visors adjustment shall be made easily by hand with positive locking and releasing devices and shall not be subject to damage by over-tightening. Sun visor construction and material shall be strong enough to resist breakage during adjustment. Visors may be transparent but shall not allow visible light transmittance in excess of 10%. Visors where deployed shall be effective in the driver's field of views at angles more than 50 above horizontal.26.3.2An electric horn conforming to BIS: 1884-1993 or latest and installation requirements conforming to AIS 014 shall be fitted in the bus and further conforming to the provisions of CMVR. No pressure horn will be fitted.

27. Speed Limiting Device.

- The bus shall be equipped with electronic speed limiting device duly approved/certified as per AIS-018/2001 or the latest. Speed limiting device shall be tamper proof and be adjusted to applicable speed limits in Punjab state and other states for inter-state routes.

28. Destination boards.

- The three destination boards of appropriate size as per the bus code and with each written in English and Punjabi must be installed at the front, rear and side of bus as per the following details.28.1Front Destination Board. - There shall be display of destination with options in Punjabi and English along with route number in Arabic numerals. The display shall be clearly visible in all weathers at a distance of 50 m.28.2Side Destination Board. - There shall be display of destination with options in Punjabi and English along with route number in Arabic numerals. The display shall be clearly visible in all weathers at a distance of 5m.28.3Rear Destination Board. - There shall be display of destination with options in Punjabi and English along with route number in Arabic numerals. The display shall be clearly visible in all weathers at a distance of 15 m. 29.0Bumpers.-

29.1 The bus shall be provided with front and rear bumper of FRP molded in three piece constructions. The bumper shall be easily repairable/replaceable. The bumpers shall conform to the requirements of CMVR, AIS (069), Bus Code/any other international standard.30.0Towing device.- Heavy-duty ring type towing devices shall be provided in the front and rear bumpers area with load transfer to bus structural members. The capacity of each towing device shall be 1.2 times (minimum) the kerbed weight of the bus within 30 degrees of the longitudinal axis of the bus.31.0Wind screen-Front and Rear.- Front wind screen in the bus shall be in single piece design, plain/flat with curved corn, PVB film laminated safety glass of minimum thickness of 8.00 mm. Rear windscreen shall be in single piece design, curved with flat in centre toughened glass of thickness of 5.5. mm (+0.3 mm). Windscreen glasses shall meet the requirements of BIS 2553: Part II-1992 or latest and that of CMVR and Bus Code. The glazing used for fitment of glasses shall be Ethylene Propylene Die Monomer (EPDM) rubber of black colour or pasted with adhesive material conforming to Indian/International Standards. A grab handle on the outside of the windshield centre at waist level shall be provided to facilitate manual cleaning of the windscreens.32.0Wind screen wipers.- Electrically operated wind screen wiper system having two wiper arms with blades shall be provided. The wiper motor shall be heavy-duty steel body for minimum of two-speed operations. The wiper arms shall rest horizontally when not in use. The sweep angle shall be sufficiently wide for clear view during rainy days. The windscreen wiping system shall be 24 V, variable speed, pantograph type fitted with time delay relay. The windshield washer system shall deposit washing fluid on the windshield and when used with the wipers, shall evenly and completely wet the entire wiped area. The windshield washer system shall have two minimum 2.5 litre tanks located for easy refilling from inside the bus and two Nozzles at suitable location for proper spray of fluid. Reservoir pumps, lines and fitting shall be corrosion resistant and reservoir itself shall be translucent for easy determination of fluid level. The windscreen wiping system shall be in accordance with CMVR/BS: 7827 Part 1, 2, 3 (section 1, 2) or latest.33.0Fire extinguishers.- Multi purpose fire extinguishers shall be ISI marked conforming to BIS: 13849-1993 or latest, dry power type (Stores pressure) duly filled, of capacity and quantity as per the provisions of GSR-853(E), dated 19th November, 2001 notification of Government of India, Bus Code. Fire extinguishers shall be fitted with proper reinforcement. The enclosure box shall have transparent breakable glass at front cover.34.0First aid kit.- First aid kit competes with items, medicines, bandages etc. shall be provided as per the provisions of CMVR fitted near driver seat at appropriate position and level on side with proper reinforcement.35.0Bus dimensions.- The bus shall be with wheel base of 6100 mm to 6500 mm (with ramp over angle from 4.8 deg. to 5.1 deg.) with the front and rear overhang shall not exceed than as specified in MVA/CMVR. The total length of the bus shall be max. 12 metres (1200 mm) with minus tolerance of 100 mm. The total width of the bus shall be 2600 with minus tolerance of 30 mm. The overall height of the bus shall be maximum 3800 mm. The approach and departure angles shall not be less than 9 degree each in unladen condition. The approach angle is the angle measured between a line tangent to the front tyre static loaded radius arc and the initial point of structural interference forward of the front type to the ground. The departure angle is the angle measured between a line tangent to the rear tyre static loaded radius are and the initial point of structural interference rearward of the rear tyre to the ground. The turning circle radius shall be as per IS 9435-1980 (or latest) the ground clearance within the wheelbase shall not less than 270 mm. The Axle clearance shall not be less than 191 mm. Axle zone clearance is projected area between the tyres and wheels on the same axial centerline- The wheel area cleareance shall not be less than 254

mm for parts fixed to the bus body and 203 mm for the parts that move vertically with Axles. Ramp over angle required for clearing ramp height of 270 mm shall be 4.8 to 5.1 as given below:

Sr. No.	Wheel base (mm)	Ramp over angle (degrees)
1	6100	5.1
2	6300	4.9
3	6500	4.8

Note. - Ramp over angle is defined as tangent inverse of 270 mm divided by half of the wheelbase.36.0Battery, Alternator, Self-starter.- 36.1 The battery system shall be 24 V of minimum 180 Amps-hour capacity, sealed and maintenance free type lead acid batteries. The batteries shall be well secured to a hinged/pivoted or slide out type carrier for ease of access for repair and maintenance, replacement and suitably ventilated for escape of fumes but insulated against ingress of dust and moisture. The battery box shall be mounted near/next to the engine compartment and shall be well secured, easily accessible and ventilated. Performance requirements of the batteries shall conform to B1S: 7372-1995 (or latest).36.2Battery terminals with positive locking system (e.g. angle type terminal with provision for double bolting) duly protected against all possible short circuit risk shall be provided.36.3Each battery cable shall be covered with flame retardant Gray colour corrugated flexible pipe and shall be properly encased and clamped.36.4A relay controlled battery cut-off switch (isolator switch) shall be provided near the driver seat on side panelling at appropriate level for disconnecting all battery positives except for safety devices such as wire suppression system and other systems as specified. Two points of battery cut off switch shall be connected with the battery and two points shall be connected with self-starter. The battery cut-off switch with the power plant operating shall not damage any components of the electrical system in off position. The battery cut-off switch shall be capable of carrying and interrupting the total circuit load.36.5The bus shall have 24 Volt D.C. with double pole wiring for all its Electrical equipments except in unavoidable circumstances to avoid sparking in bus. A separate system/mechanism shall be provided for the discharge of electro static charge induced during the operation of vehicle. A precaution shall be taken in case of single pole wiring to avoid spark in items such as self, alternator etc.36.6An adequate capacity alternator of 24 V D.C. with consistent output shall be provided and so located as to minimize ingress of oil or rain water into it.36.7A pre-engaged type 24 V D.C. self-starter of adequate capacity with relay shall be fitted in the bus and so located as to minimize ingress of oil or rain water into it.37.0Electrical Equipment and wiring.- 37.1 Electrical equipment and wiring shall be conforming to Indian/international standards. All cabling shall be as per the provisions of the Bus-code. The wiring shall be flame proof, ISI marked conforming to BIS-2465-1984 or latest. As far as possible electrical system shall be 24 V double pole wiring except in unavoidable condition. However, in case of single pole wiring all power and ground wiring shall have double electrical insulation, which shall be waterproof conforming to the Indian/International Standards. Wiring shall be grouped, numbered and colour coded. Wiring harness or insulated for the highest voltage present in the harness. Kinking, grounding at multiple points, stretching and exceeding minimum bend radius shall be prevented.37.2The wiring looms/harness for vehicle system of the bus shall be properly routed, encased/concealed type so mounted to eliminate chances of any spark. The manufacturer shall be required to provide the details of the above wiring loom including circuit diagram, lay out of controls etc. Wiring support shall be protective and

non-conducted at areas of wire contact and shall not be damaged by heat, water, solvents or chaffing.37.3All electrical fittings and lights shall be fully wired up, running in flame retardant black colour PVC sleeves as per applicable Indian standards and installed in a manner to facilitate easy inspection/rectification/replacement etc. as and when required without disturbing internal finish/decor of the bus. Whenever any wire or cable or PVC sleeve carrying cable etc. passes through holes in the sheet metals/ structural member, suitable rubber gromments/Bakelite, inserts shall be provided in these holes to avoid direct contact between cables and sheet metal causing damage to the insulation coating.37.4Design of the electrical, electronic and data communication system shall be modular so that each major component, apparatus panel or wiring bundle is easily separable with standard hand tools or by means of connectors. Each module except the main body wiring harness shall be removable and replaceable. Power Plant wiring shall be an independent wiring module. Replacement of engine compartment wiring module shall not require pulling wires through any bulkhead or removing any terminals from the wires.37.5The electrical system and its electronic components shall be capable of operating in the area of the vehicle in which they will be installed. Electrical and electronic equipment shall not be located in an environment that will reduce the performance or shorten the life of the component or electical system. No vehicle component shall generate or be affected by electro-magnetic interference or radio frequency interference (EMI/RFI) that can disturb the performance of electrical/electronic equipments.37.6All the electrical and electronics hardware shall be accessible and replaceable easily. It shall be mounted on an insulating panel to facilitate replacement. The mounting of the hardware shall not be used to provide the source ground and all hardware shall be isolated from potential EMI/RFI.37.7All electrical/electronic hardware mounted in the interior of the bus shall be inaccessible to passengers and hidden from view unless intended to be viewed.37.8All electrical/electronic hardware mounted on the exterior of the vehicle i.e. not designed to be installed in an expose environment shall be mounted in a sealed enclosure.37.9All electronic hardware and its mountings shall comply with the shock and vibration requirements.37.10All branch circuits except battery to starting motor and battery to generate/alternator circuits shall be protected by circuit breakers or fuses sized to the requirements of the load. Electronic Circuit protection for the cranking motor shall be provided to prevent engaging of the motor for no more than 30 seconds at a time to prevent overheating. Circuit breakers or fuses shall be sized to a minimum of 15% larger than the total circuit load current. The current rating for the wire used for each circuit must exceed the size of the circuit protection being used.37.11To the extent possible wiring shall not be located in environmentally exposed locations under the vehicle. Wiring and electrical equipments necessarily location under the vehicle shall be insulated from water, heat, corrosion and mechanical damage. Where feasible front to rear electrical harnesses should be installed above the window line of the vehicle.37.12All Electrical motors shall be easily accessible for servicing.37.13Two separate additional outlets are to be provided with appropriate relays and fuses in wiring harness for fitment of electrical auxiliary devices/systems to be added later on in the buses, if required.37.14One DC -AC converter output of 110--220V is also to be provided at suitable location for charging of electrical/electronic, equipment like Mobile Phone, etc.37.15If any electronic components have an internal clock, it shall provide its own battery back up to monitor time when battery power is disconnected.37.16All electronic component suppliers shall ensure that their equipment is self-protecting in the event of shorts in the cabling and also in over-voltage and reverse polarity conditions. If an electronic component is required to interface with the other components it shall not require external pull up and/or pull down resistors.38.0Lights and

Lighting System.- All the lighting Installation should be as per AIS 008 Standards.38.1Interior saloon lighting shall be sunken type tube light assembly fitted with 24V, 20W transistorized inverter as per BIS 7027:1984 or latest with 2 ft long slim type fluorescent tube of 18W as per BIS 2418 (part 1)-1977 (or latest), and mounted in staggered formation for uniform lighting in two separate circuits. The first row of lamps provided in the driver's cabin should be fitted with amber internal fitter to reduce glare to driver at night.38.2Modern rectangular type/round/asymmetrical headlamps with relay and side light etc. shall be suitably styled into front-end construction.38.3White and Red marker lights of 5 Watts shall be fitted for both top side comers of the front and rear panel of the bus respectively.38.4Identical signal lights of 15 Watts shall be fitted for interchangeability in each side of front.38.5Brake lights (15 W) and taillights (10 W) shall be two separate lights to reduce heat generation.38.6Reverse light of 25 W, square lamps with white covers shall be provided.38.7Side markers shall be provided on both sides as per bus code/AIS 008.38.8Rear signal lights, brake lights taillights and reverse lights shall be arranged vertically.38.9The light wattage given above are indicative; however, all the lights and lighting systems shall conform to the requirements of Bus code, CMVR/Punjab MVR and other relevant AIS standards.38.10A well-lighted bus registration number plate shall be fitted at rear as per the provisions of CMVR. The owner shall be required to comply with the directives/regulations regarding high security plates as/to be notified by the Government of India in the near future.38.11Electrical fittings shall not be mounted on both front and rear bumpers.38.12Switches shall be fitted on the right hand side of the instrument panel through evenly loaded circuits and fuses as per the bus code.38.13A reverse buzzer shall be installed at the rear of the bus to sound intermittently when reverse gear is engaged.38.14A suitable light shall also be provided in the engine compartment for ease of maintenance/emergency repairing.39.0Performance Statements.- The manufacturer shall furnish the following information for the inspection of the bus:

1. Type/Model

2. Maximum/minimum turning radius/diameter.

3. Maximum climbing ability-grade ability

4. Type of bus body.

5. Engine HP @. RPM

6. Engine Torque @ RPM

7. GVW of buses

8. Emission Norms

9. Type of suspension

10. Dimensions-Length, width, height, floor height, wheel base

11. Axle-Rear and front

12. Passenger carrying capacity

13. Any other performance data

40. Tools, Gauges and Testing Instruments.

- The chassis manufacturers and bus body builders shall be required to furnish list of special tools, gauges and testing instruments for inspection, repair and maintenance of the buses alongwith a complete list of spare parts recommended for normal wear and tear ; and Emergency requirements for any breakdowns, damages etc.

41. Operation and Maintenance Manual.

- At least 10 hard bound copies for every 100 buses or part thereof of operation and maintenance manual containing essential technical information required for satisfactory operation, inspection and maintenance shall be supplied by the chassis manufacturers and bus body builders to the State Transport Commissioner.(i)One set of Colored wall charts shall also be provided of the following units for every ten buses showing assy. details :Chassis lubrication and brake system.(ii)One set of colored wall charts of the following units for every fifty buses showing assy. details :EngineTransmission system/Gear boxRear AxleFront AxleClutch

42. Training.

- For each lot of 100 buses or part thereof, following training shall be provided by the chassis manufacturers and bus body builders. The manufacturers and bus body builders shall arrange orientation training at Chandigarh for two days for 250 drivers in batches of 25 (total 500 man-days). Similarly orientation training at Chandigarh for 3 days for 200 technicians/supervisions/engineers in batches of 25 (total 600 man days). Bus/fuel/available facilities with the purchaser will be provided by the purchaser and corse materials will be provided by chassis manufacturers and bus body builders on free of cost basis. This training will be provided free of cost, as and when required by the Purchaser.

43. Tool kit.

- The chassis manufacturers and bus body builders shall 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. The complete list of tools in the tool kit to be supplied with every bus shall be provided to the purchaser.

44. Maintainability .

- The fabrication of bus shall be manufactured in such a manner that facilitates easy access for repair and maintenance, removal, replacement of various bus components/assemblies/sub-assemblies/ systems by providing suitable traps/flaps etc. Also removal and re-fitment of engine, transmission, radiator etc. shall be easy for repair and maintenance purpose. Radiator coolant/water filling shall be easily accessible with suitable closures with locking arrangement, holding arrangement. Also an access door shall be provided on rear side paneling for attending to air cleaner assemblies mounted in the vehicle.

45. General Requirements.

- 45.1 Ministry of Road Transport and Highways, Government of India (MORT&H),-vide Notification No. GSR-853(E), dated 19th November, 2001 in the Gazette of India, inter alia stipulated the following measures need to be complied for enhancement of safety by the Vehicle Manufacturer as per the statutory requirement for registration of vehicles.45.1.1While registering every bus, Vehicle Manufactures/bus body builders and transport authority shall jointly examine the bus prior to registration. The registration of such a vehicle is done only after signing the report jointly by all concerned alongwith the Transport Authority.45.2All edges shall be rounded off and shall not cause injury to bus occupants.45.3Complete bus shall be rattling free.45.4All the rivets and bolts holes shall be jig drilled as far as possible or manually drilled. Rivet heads neatly formed and each bolt rivet shall be tightened after full mating of the surfaces to be fastened.45.5All safety aspects should be considered while designing and fabricating the bus.45.6Continuous type, piano type hinges and towers bolts of stainless steel shall be used as per relevant Indian Standards.45.7Similarly Aluminium extruded sections wherever not painted shall be anodized.45.8Al1 flaps wherever provided should have heavy-duty support to keep it open for ease of maintenance.45.9All miscellaneous M.S. pipes shall be cold phosphated with the coating of 2.16 to 2.70 gm/m2 or by any other pre-treatment process conforming to Indian/International Standards. The samples of all materials and connections shall withstand a two weeks (336 hours) Salt Spray test in accordance with ASTM procedure B 117 with no structural detrimental effect to normally visible surfaces and no weight loss of over 1 %.45.10Anodized decorative aluminum mouldings/beadings etc. shall be used.45.11All M. S. pipes used in the bus shall be ERW @ conforming to BIS 3601L1984 of latest, of grade WT-160.45.12All rubber items shall be made of Ethylene Propylene Dien Monomer (EPDM) rubber of black colour conforming to the Indian/International Standards to be specified by the Bidder.45.13EPDM rub rail of aesthetic profile shall 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 shall be as per the Indian/International Standards....45.14Every trap/opening flap shall be secured in a manner that the vibrations can't dislodge it. Lifting devices must not protrude above the flap.45.15Ease of accessibility to engine and other aggregates for easy maintenance shall be ensured. Assemblies/units shall be so mounted that they are easily accessible and can be removed without

disturbing other components/assemblies.45.16All structure, body, and panel-bending mode frequencies, including vertical, lateral and tensional modes, shall be sufficiently removed from all primary excitation frequencies to minimize audible, visible, or sensible resonant vibrations during normal service.45.17Exterior protrusions if any shall conform to the provisions of relevant CMV/AIS Bus Code. The exterior rear-view mirrors and required lights and reflectors are exempted from the protrusion requirement. Advertising frames shall protrude no more than 22mm from the body surface and shall have the exposed edges and corners rounded to the extent practicable. Grilles, doors, bumpers and other features on the sides and rear of the bus shall be designed to minimize the ability of unauthorized riders to secure toeholds or handholds. The exterior body features shall be shaped to allow complete and easy cleaning by automatic bus washers without snagging washer brushes or relating water and dirt.45.18Hydraulic Grease Nipples shall be provided for ease of proper lubrication and maintenance.45.19The front panels, bumpers and grill should be designed such that there are no pointed or sharp protrusions to minimize injuries to vulnerable road users in case of impact.

46. Quality Assurance.

- 46.1 The chassis manufacturers and body builders shall use materials including fasteners conforming to relevant Indian/International Standards and shall get the same protested before use, meeting requirements of all the specified parameters to ensure quality of the material specified, from CIRT, Pune)ARAI/BIS approved testing laboratories having testing facilities for testing all the parameters of the specifications of the materials/items. In the event of failure of samples in lab tests the testing shall be conducted in the same way again from the fresh lot.46.2The completed bus shall be subjected to water leakage test conforming to BIS: 11885-1986 or latest.

47. Statutory Requirement.

- The bus shall meet all statutory requirements in respect of each and every item of the bus. The manufacturer or body builder shall also get typed approval certificate etc. for bus and any other items from the testing agencies specified in the CMVR namely Vehicle Research and Development Establishment, Ahmednagar of the Ministry of Defence of the Government of India or Automotive Research Association of India, Pune or the Indian Institute of Petroleum, Dehradun as specified by the Central Government on the date of testing type approval. A certificate showing details of make/type/model of various units like engine, gear box/Automatic transmission system, clutch assembly, propeller shafts, rear axle, radiator, alternator starter, regulator; batteries, tyres, instruments on the panel air compressor shock absorbers, road springs etc. shall be furnished by manufacturer or body builder to the purchaser.

48. Manufacturer's name plate.

- Manufacture's name plates may be fixed as per the following locations :One inside at front left of the bus.One outside at rear right of the bus.One logo, if any, the front face preferably in the centre.

49. Pollution Under Control (PUC) Certificate Holder.

- A suitable holder with clear acrylic sheet cover shall be provided in driver cab near driver seat at appropriate level for fixing of PUC certificate.