Draft AIS-216/DF
May 2025

(Strikeout text deleted as decided in 29 Apr 25 meeting,
Modified Text is in blue)

AUTOMOTIVE INDUSTRY STANDARD

CODE OF PRACTICE FOR BUS BODY DESIGN AND APPROVAL FOR TYPE 1 BUSES

Date of hosting on ARAI website: 30th May 2025
Last date for comments: 30th June 2025

CODE OF PRACTICE FOR
BUS BODY DESIGN AND APPROVAL

CONTENTS (to be modified)

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MOST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No.RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India, (ARAI), Pune, being the Secretariat of the AIS Committee, has published this standard. For better dissemination of this information ARAI may publish this document on their web site.

Based on the discussions in 63rd meeting of CMVR TSC, Committee directed AISC to formulate a working group under CIRT, to deliberate on the subject and present its recommendations in the next meeting of CMVR-TSC. To review of provisions for accessibility for people with reduce mobility in Type –I Buses, there is a need to review the subject by a working group and based on the directions received from the MoRTH a separate AIS standard need to be formulated to address requirements for Type-1 buses. This standard has been formulated covering requirements for Bus Construction viz., requirements for Fire Suppression System, requirements for accommodation and accessibility for passengers of reduced mobility, access to emergency door/window, Escape hatches and mandatory requirement for escape hatches, requirements for noise, vibration and harshness etc. While developing this standard reference has been taken from AIS-052 (Rev 1) with Cori. 1 and Amds. (1 to 13), AIS 153 with (amd. 1-6) and UN R 107.

The AISC panel and the Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annex-VII and Annex-VIII respectively.

CODE OF PRACTICE FOR BUS BODY DESIGN AND APPROVAL For Type 1 Buses

CHAPTER: 1
SCOPE & DEFINITIONS

1.0 SCOPE

The provisions of this code are applicable to Type I buses with a seating capacity of 13 passengers or above excluding driver.

1.1 **Definitions - For the purpose of this code :**

1.1.1 **'Vehicle/Bus'** means a four or more wheeled motor vehicle designed and constructed for the purpose of transportation of 13 passengers or above excluding driver.

1.1.1.1 **'Articulated Vehicle/Bus'** means a vehicle which consists of two or more rigid sections which articulate relative to each other; the passenger compartments of each section is interconnected by an articulate section allowing free movement of passengers between them; the rigid sections are permanently connected and can only be separated by an operation involving facilities which are normally found in a work shop.

1.1.2 **'Bus Body'** means the portion of a bus that encloses the bus's occupant space, exclusive of the bumpers, the chassis frame any structure forward of the forward most point of the windshield mounting.

1.1.3 **'Ladder Type Chassis'** means the chassis frame of the vehicle and is the main load bearing element. The general construction of ladder frame consists of side and cross members. The side and cross members are connected with special gusset sections or pressed cross member sections The junctions are riveted, bolted or welded.

1.1.4 **'Monocoque Construction'** means a type of bus body structure where the body and base frame are joined together either by welding or by other methods to form an integral structure. These structural elements consist of pressed grid type of support elements and rectangular sections.

1.1.5 **'Type I'** Vehicles are the medium and high capacity vehicles designed and constructed for urban and sub urban / city transport with area for standing passengers, to allow movement of passengers associated with frequent stops and the low capacity vehicles which are designed and constructed for urban and sub urban / city transport exclusively for carrying seated passengers. The low capacity vehicles in this type can carry standee passengers if they meet provisions for low capacity standee buses.

1.1.9 **'Low Capacity'** Vehicles include –

(1) Mini Bus : Seating capacity between 13 to 22 passengers plus driver.

1.1.10 **'Medium Capacity'** Vehicles include -

(1) Midi Bus-: Seating capacity between 23 to 34 passengers plus driver.

(2) Standard Bus : Seating capacity between 35 to 70 passengers plus driver.

1.1.11 **'High Capacity'** Vehicles are the vehicles with seating capacity more than 70 passengers plus driver and include vehicles such as Single Deck Articulated Bus, Single Deck Double Articulated Bus, Double Deck Bus, Double Deck Articulated Bus and Single Deck Tandem Axle Bus etc.

Note : For the purpose of defining the seating capacity, a standard 3x2 layout with a seat spacing of 686 mm and seat width of 400 mm per passenger has been considered to arrive at permissible maximum seats. The computation takes into consideration areas not available for seating passengers, such as driver compartment, engine compartment, stepwell gangway etc.

1.1.12 **Non-Deluxe Bus (NDX)** means bus designed for basic minimum comfort level.

1.1.13 **Semi Deluxe Bus (SDX)** means a bus designed for a slightly higher comfort level and with provision for ergonomically designed seats.

1.1.14 **Deluxe Bus (DLX)** means a bus designed for a high comfort level and individual seats and adjustable seat backs, improved ventilation and pleasing interiors.

1.1.15 **A.C. Deluxe Bus (ACX)** means a *Deluxe Bus* which is air conditioned.

1.1.15.1 Provision of Air conditioning (AC) may optionally be provided in NDX / SDX buses

1. 1.16 **'Door'** means a sub system of a bus body that permits boarding and alighting of passengers. Door may or may not be with panel (hinged / sliding) for closing it.

1.1.16.1 **'Service Door'** means a door intended for use by passengers in the normal circumstances.

1.1.16.2 **'Double Door'** means a door affording two, or the equivalent of two, access passages.

1.1.16.3 **'Sliding Door'** means a door, which can be opened or closed only by sliding it along one or more rectilinear or approximately rectilinear rails.

1.1.16.4 **'Power operated Service Door'** means a service door which is exclusively operated by energy other than muscular energy and the opening and closing of which is controlled by driver or jointly by driver and crew member.

Note : In case of Indian requirement conductor (crew member) control may be necessary to operate the doors.

1.1.16.5 **'Automatically Operated Door'** means a power operated service door which can be opened by a control, operated by a passenger, after activation of the control by

the driver and which will close automatically.

1.1.16.6 '**Emergency Door'** means a door intended for use as an exit by passengers in an emergency only.

1.1.17 '**Exit'** means a service door or emergency exit.

1.1.17.1 '**Emergency Exit'** means an emergency door, emergency window or escape hatch.

1.1.18 '**Window'** means an aperture in the sides of the bus to let in light and air. The window need not necessarily be glazed.

1.1.18.1 '**Emergency Window'** means a window, intended for use as an exit by passengers in an emergency only.

1.1.18.2 **'Double Window'** means an emergency window which, when divided into two or more parts by imaginary vertical line or (plane), exhibit two parts respectively, each of which complies as to dimensions and access with requirement applicable to a normal emergency window.

1.1.19 **'Escape Hatch'** means a roof opening intended for use as an exit by passengers in an emergency.

1.1.20 **'Floor or Deck'** means that part of the body works whose upper surface supports standee passengers, the feet of seated passengers and driver, and support the seat mountings.

1.1.21 **'Gangway'** means the space providing access to passengers from any seat or row of seats to another seat or to any access passage; it does not include:

- The space required to accommodate the feet of the seated passengers;
- The space above the surface of any step or staircase; or
- Any space which affords access to one seat or row of seats

1.1.22 **'Access Passage'** means the passage through a doorway to a gangway.

1.1.23 **'Passenger'** means a person other than the driver.

1.1.24 **'Passenger Compartment'** means the space intended for passenger use excluding any space by fixed appliances or luggage/storage compartments.

1.1.25 **'Driver Compartment'** means the space intended for the driver's exclusive use and contains driver seat, steering wheel, controls, instruments and other devices necessary for driving or operating the vehicle.

1.1.26 **'Unladen kerb Mass'** means the weight of the vehicle in running order, unoccupied and unladen but complete with fuel, coolant, lubricant, tools and spare wheel.

1.1.27 **'Gross Vehicle Weight'** means technically permissible maximum weight

declared by the manufacturer of the vehicle and certified by the test agency.

1.1.28 **'Seat'** means a structure complete with trim, capable of accommodating one or more adult person.

1.1.28.1 '**Individual seat'** means a seat designed and constructed for the accommodation of one passenger.

1.1.28.2 '**Double seat'** means a seat designed and constructed for the accommodation of two passengers side by side. Two seats side by side and having no interconnection shall be regarded as two individual seats.

1.1.28.3 '**Continuous seat'** means a seat designed and constructed for the accommodation of two or more passengers side by side.

1.1.28.4 '**Driver seat'** means the front seat intended for the seating of the driver.

1.1.28.5 '**Co-driver seat'** means the front seat, on the opposite side of the driver seat, intended for seating the co-driver / conductor / helper / cleaner.

1.1.28.6 **'Passenger seat'** means the seat intended for seating passengers.

1.1.29 '**Seat cushion'** means the part of the seat which is arranged almost horizontally and designed to support a seated passenger.

1.1.30 '**Seat-back'** means the part of the seat that is almost vertical, designed to support the passenger's back, shoulders and, possibly his head.

1.1.31 '**Adjustment system'** means the device by which the seat or its parts can be adjusted to a position suited to the seated occupant.

1.1.32 '**Displacement system'** means a device enabling the seat or one of its parts to be displaced laterally or longitudinally without a fixed intermediate position of the seat or one of its parts, to facilitate access by passengers.

1.1.33 '**Locking system'** means a device ensuring that the seat and its parts are maintained in the position of use.

1.1.34 '**Anchorage'** means a part of the floor or of the body of a vehicle to which a seat is fixed.

1.1.35 **'Seat Frame'** means structural portion of the seat assembly. The seat frame may be constructed with springs attached to the structural frame or may support padding.

1.1.36 **'Padding'** means soft and resilient material installed between the seat frame sub assembly and trim covering.

1.1.37 **'Trim'** means a part of the seat assembly providing an envelope for the seat frame and the padding. also provides surface, appearance, comfort and interior styling.

1.1.38 '**Attachment fittings'** means bolts or other components used to attach the seat to the vehicle.

1.1.39 '**Reference plane'** means the plane passing through the points of contact of the heels of the manikin, used for the determination of the H point and the actual

angle of torso for the seating position in motor vehicles.

1.1.40 '**Reference height'** means the height of the top of the seat above the reference plane.

1.1.41 **'Reference zone'** means the space between two vertical longitudinal planes, 400 mm apart and symmetrical with respect to the H-point, and defined by rotation from vertical to horizontal of the head-form apparatus whose dimensions from the pivotal point of the hip to the top of the head is continuously adjustable between 736 mm and 840 mm.

1.1.42 '**Seat spacing'** means, the distance between the front of a seat squab and the back of the seat squab of the seat preceding it, measured horizontally at a height of 620 mm above the floor.

1.1.43 **'Transverse Plane'** means a vertical plane perpendicular to the median longitudinal plane of the vehicle.

1.1.44 **'Longitudinal Plane'** means a plane parallel to the median longitudinal plane of the vehicle.

1.1.45 '**Head Restraint'** means a device whose purpose is to limit the rearward displacement of an adult occupant's head in relation to his torso in order to reduce the danger of injury to the cervical vertebrae in the event of an accident.

1.1.45.1 **'Integrated Head Restraint'** means a head restraint which can only be detached from the seat or the vehicle structure by the use of tools or by partial or complete removal of the seat covering meet the present definition.

1.1.45.2 **'Detachable Head Restraint'** means a head restraint consisting of a component separable from the seat, designed for insertion and positive retention in the seat-back structure.

1.1.45.3 **'Separate Head Restraint'** means a head restraint consisting of a component separate from the seat, designed for insertion and/or positive retention in the structure of the vehicle.

1.1.46 **'H-Point'** means a pivot center of the torso and thigh on the two or three dimensional device used in defining and measuring vehicle seating accommodation.

1.1.46.1 **'Design H-Point'** is located on a drawing by the H-point on the two dimensional drafting template placed in any designated seating position.

1.1.47 '**R-point'** or '**Seating Reference Point'** means the manufacturer's design H-point which establishes the rearmost normal driving or riding position of each designated seating position as stipulated by the manufacturer and which accounts for all modes of adjustments (horizontal, vertical and tilt) that are available for the seat; has co-ordinates established with respect to the designed vehicle structure; simulates the position of the pivot centre of the human torso and thigh; and is the reference point employed to position a two-dimensional template.

1.1.48 '**Torso Reference Line'** means a straight line passing through the joint between the leg and the pelvis and the theoretical joint between the neck and thorax of

the manikin.

1.1.49 **'Cab lamp** or **Courtesy lamp'** are lamps situated above the head of the driver lighting up the dash board area and inside of the cabin. This is meant for operation while the bus is stationary. The cab lamp shall be capable of being operated only for a momentary duration while the bus is in motion.

1.1.50 **'Exit lamps'** are lamps to light up the running boards. They are to light up automatically when the doors for exit or entry are opened. In the absence of closable doors at the entry and exit point, the lights are to be permanently lit during night operations of the bus.

1.1.51 **'Locker lamps**' are lamps to light up the inside of the locker when the door to the locker is opened, illuminating interior of the locker.

1.1.52 **'Electrical distribution panel lamp'** are lamps meant to light up electrical distribution panel when the cover to the distribution centre is opened for checking and maintenance purposes.

1.1.53 **'Instrument lighting'** are lights that light up individual instruments. These can be connected to a single control through a rheostat. By varying the control, the strength of the instrument lighting can be regulated by the driver while driving in the dark to avoid glare from instrument lighting.

1.1.54 **'Control unit lamps'** are similar to instrument lighting. However, these lamps illuminate individual controls discreetly to assist driver for identifying the controls.

1.1.55 **'Passengers area lamps'** are lamps to light up the passenger area and assist passenger in identifying objects and reading the printed matter.

1.1.56 **Components of Body structure (Ref. Appendix 1)**

1.1.56.1 '**Cross Bearers'** are structural members mounted on the chassis frame through 'U' Bolts or out rigger brackets. The cross bearers transmit the body load to the chassis and also withstand the forces induced during the normal operation of the vehicle.

1.1.56.2 '**Vertical pillars'** (body pillar) are structural members that support the roof structure and are connected to the cross bearers through gussets. The Vertical pillars transmit load to the cross bearers and also withstand the forces induced during the normal operation of the vehicle.

1.1.56.3 '**Roof Arch Members'** are structural members that connect the vertical pillars and form a body section. In the event of a rollover, the body section absorbs the impact and provides survival protection in the passenger compartment. Gussets are also provided to improve the rigidity and strength of the body section.

1.1.56.4 '**Cant rails**' are structural members that connect two body sections above the window section.

1.1.56.5 '**Waist Rails'** are structural members that connect two body sections below the window section.

1.1.56.6 **'Sole Bars'** are structural members that connect two body sections at the floor

plane.

1.1.56.7 '**Seat Rails'** are structural members running along the lateral walls and provide support for seat mounting.

1.1.56.8 '**Floor Runners'** are structural members that connect cross bearers.

1.1.56.9 '**Roof Runners'** structural members that connect roof arch members.

1.1.56.10 '**Out- Rigger Brackets'** are attachments that provide connection between the cross bearers and the chassis frame.

1.1.56.11 '**"U" Bolts'** are fasteners used for fastening the cross bearers to the chassis frame.

1.1.56.12 '**A Pillar'** means any roof support forward of seating reference point.

1.1.56.13 **Front Outrigger Members** are provided to transfer load of Body structure members. These are fixed to the chassis side members . "A" pillars are supported on outrigger members such that the roof load is transferred to the chassis load bearing members. Further in the event of a collision the energy is absorbed by the pillars and the out riggers and minimise the impact energy transmitted to the driver and passenger compartment.(Protection against frontal collision)

1.1.57 **'Bituminous Coating'** means Coal tar or asphalt based coating.

1.1.58 **'Chromated Parts'** mean parts treated with chromic acid to improve their corrosion resistance.

1.1.59 '**Conversion coating**' means an adherent reaction product layer on a metal surface with a suitable chemical; such as an iron phosphate.

1.1.60 '**Corrosion means'** the deterioration of a material, usually a metal, because of a reaction with its environment.

1.1.61 '**Contact Corrosion/Bimetallic corrosion'** means galvanic corrosion between two dissimilar metals.

1.1.62 '**Electro-Coating'** means a method of coating a metal deploying high voltages between an anode and a cathode in an electrolyte.

1.1.63 '**Electrogalvanised-steel'** means steel sheet produced by continuously electroplating zinc onto the steel surface.

1.1.64 '**Metalising'** means a process of coating a surface with a layer of metal by spraying, vacuum deposition, dipping, plasma jet, cementation etc.

1.1.65 '**Organic coating'** means primarily paints applied to metallic or other substrates to provide corrosion protection and to improve aesthetic characteristics of the material.

1.1.66 '**Phosphate Coating**' means protective coating formed by reaction of a metallic substrate with an acid phosphate containing solution.

The primary role of the phospating coating is to enhance the adhesion of the primer (electro coat or others) to the metal. Phosphate coatings are typically

Zn-Fe, Zn-Ni. or Zn -Ni -Mn phosphates.

1.1.67 '**Precoated *material***' means a material that has been coated prior to the manufacture of the ware or part.

1.1.68 '**Pretreatment**" means a surface treatment prior to the process of interest (e.g., phosphating prior to painting).

1.1.69 '**Prime Coat**' means the first coat of paint applied to inhibit corrosion and /or improve adhesion of the next coat.

1.1.70 '**Primer**' means the paint applied as the prime coat, formulated to have good bonding and wetting characteristic, and may or may not contain inhibited pigments.

1.1.71 '**Rust**' means corrosion product mainly consisting of hydrated iron oxides and applied only to iron and ferrous products.

1.1.72 '**Rust proofing'** means application of coatings intended to prevent or greatly reduce the formation of rust on steel parts.

1.1.73 '**Sealers**' means product applied to joints or seams to prevent the entry of moisture or contaminants or to enhance adhesion or corrosion protection.

1.1.74 **"Low floor vehicle"** means a vehicle in which at least 35 per cent of the area available for standing passengers (or of its forward section in the case of articulated vehicles) forms a single area without steps, reached through at least one service door by a single step from the ground.

1.1.75 **"Safety sign"** means sign giving a general safety message, obtained by a combination of a colour and geometric shape and which, by the addition of a graphical symbol, gives a particular safety message.

1.1.76 **"Emergency lighting system"** means a system that provides a minimum level of lighting necessary to enable occupants to safely egress from the bus, including the emergency exits.

1.1.77 **"Passenger with reduced mobility"** means all passengers who have a difficulty when using public transport, such as disabled people (including people with sensory and intellectual impairments, and wheelchair users, people with limb impairments, people of small stature, people with heavy luggage, elderly people, pregnant women, people with shopping trolleys, and people with children (including children seated in pushchairs).

1.1.78 **"Wheelchair user"** means a person who due to infirmity or disability uses a wheelchair for mobility.

1.1.79 **"Priority seat"** means a seat with additional space for a passenger with reduced mobility and marked accordingly.

1.1.80 **"Boarding device"** means a device to facilitate wheelchair access to buses, such as lifts, ramps, etc.

1.1.81 **"Lift"** means a device or system with a platform that can be raised and lowered to provide passenger access between the floor of a passenger

compartment and the ground or kerb.

1.1.82 **"Ramp"** means a device to bridge the gap between the floor of a passenger compartment and the ground or kerb. In its position for use, it includes any surface that may move as part of the ramp deployment or be available for use only when the ramp is in its deployed position and over which a wheelchair is intended to travel.

1.1.83 **"Portable ramp"** means a ramp that may be detached from the bus structure and capable of being deployed by a driver or crew member.

1.1.84 **"Demountable seat"** means a seat that can be easily detached from the bus.

1.1.85 **“Kneeling System”** means a system which lowers and lifts totally or partially the body of a vehicle relative to the normal position of travel.

CHAPTER : 2

GENERAL REQUIREMENTS OF BUS BODY DESIGN

2.0 CATEGORISATION OF BUSES

Type 1 buses are further categorised as Non-Deluxe (NDX), Semi Deluxe (SDX), Deluxe (DLX) and A. C. Deluxe (ACX), on the basis of comfort level required by different categories of commuters.

Type 1 Buses are also categorised as Low Capacity, Medium Capacity and High Capacity buses to cater to the traffic demand pattern, as also the frequency of the traffic. A chart depicting the categorisation of buses is given in Annexure I.

The dimensional requirements for various types / categories of Type 1 buses are detailed in the following paragraphs. The corresponding technical requirements are given in Chapter 3 of this Code.

2.1 Overall Dimensions

2.1.1 Overall dimensions of the bus shall comply with the provisions laid down in Rule 93 of Central Motor Vehicle Rules, 1989, as amended from time to time.

2.1.2 **Engine / Electric traction Motor Power to Gross Vehicle Weight**

All buses shall have engine / electric traction motor power to gross vehicle weight ratio greater than 5 kW/ ton.

2.1.3 **Acceleration**

All buses shall achieve acceleration greater than 0.5 m/s^2 to achieve speed from 0 to 30 kmph within 14s when tested as per procedure laid down in IS:11851-1986 (Reaffirmed 2017), as amended from time to time.

2.2 Internal Dimensions

2.2.1 Entry / Exits

2.2.1.1 Service Doors

2.2.1.1.1 The service door(s) shall be situated on the side of the vehicle that is nearer to the side of the road corresponding to the direction of traffic.

2.2.1.1.2 The minimum width of the service door shall be at least 650 mm. This dimension shall be reduced by 100 mm for single door and 200 mm for double door when the measurement is made at the level of the hand holds

Note: For Mini / Midi / Standard buses, at least one of the service doors provided shall have aperture of width 1000 mm and height 1800 mm to accommodate wheelchair or at the choice of manufacturer, a separate arrangement for the wheelchair may be provided as per the conditions laid down in Clause No. 3.6.3 of Appendix 4 of this standard.

2.2.1.1.3 Minimum two service doors are required, the front door shall be positioned either ahead of the front axle or behind the front axle, but necessarily in the forward half of the vehicle.

2.2.1.1.4 A double service door shall be counted as two doors.

2.2.1.1.5 Each rigid section of an articulated Type 1 bus shall be treated as a separate vehicle for the purpose of calculating the minimum number of exits to be provided.

2.2.1.1.6 **Number of Service Doors**

2.2.1.1.6.1 The minimum number of service doors or apertures shall be as follows, except in case of Mini & Midi buses which shall have at least one service door or aperture:

	NDX	SDX	DLX	ACX
Type I	2	2	1	1

2.2.1.1.6.2 Minimum number of service doors for Mini and Midi buses shall be one.

2.2.1.1.6.3 In case of type I (DLX, ACX), provision of second exit shall be optional.

2.2.1.1.7 **Minimum dimensions of Service Doors**

2.2.1.1.7.1 Minimum dimensions of service door apertures for buses other than Mini & Midi buses, shall be as follows (Ref. Fig 17)-

Category		**Height Min. (mm)**	**Width min. (mm) (As Applicable) ** (1)**		
			Front	**Rear**	**Middle# (2)**
Type I	**NDX**	1800	650 (3) mm for single door and 1200 mm for double door	650 (3) mm for single door and 1200 mm for double door	650 (3) mm for single door and 1200 mm for double door
	SDX				
	DLX				
	ACX				

**(1) This dimension shall be reduced by 100 mm for single door and 200 mm for double door when the measurement is made at the level of the hand holds."

(2) Door apertures between two axles in case of rear engine buses of type I (except AC fitted buses) category."

(3) For buses other than Mini and Midi, at least one of the service doors provided shall have aperture of width 1000 mm and height 1800 mm to accommodate wheelchair or at the choice of manufacturer, a separate arrangement for the wheelchair may be provided as per the conditions laid down in Clause No. 3.6.3 of Appendix 4 of this standard.

2.2.1.1.7.2 Minimum dimensions of service doors for the Type 1 Midi and Mini buses shall be as follows –

	Midi & Mini Bus	
	Standee	**Non Standee**
Height (mm)* (1)	1650(3)	1500(3)
Width (mm)** (2)	650 (3)	650 (3)
* (1) The dimension shall be reduced by 100mm for Mini buses with Gross Vehicle Weight (GVW) less than 3.5 tons.		
**(2)This dimension shall be reduced by 100 mm for single door and 200 mm for double door when the measurement is made at the level of the hand holds."		
(3) For Mini and Midi buses, at least one of the service doors provided shall have aperture of width 1000 mm and height 1800 mm to accommodate wheelchair or at the choice of manufacturer, a separate arrangement for the wheelchair may be provided as per the conditions laid down in Clause No. 3.6.3 of Appendix 4 of this standard.		

2.2.2 Window

2.2.2.1 The window panes shall be of sliding type for all buses except AC fitted buses. However, in AC fitted buses the provision for adequate ventilation in case of A.C. failure shall be made.

2.2.2.2 The minimum width of the window aperture shall be 550 mm.

2.2.2.3 The minimum height of the window aperture shall be 550 mm for all buses and 450 mm for Midi and Mini buses. However, this dimension is not applicable to AC fitted buses.

2.2.2.4 In Type I NDX & SDX buses other than Midi and Mini buses, the upper edge of the window aperture shall be at least at the height of 1700 mm from the gangway floor area. However, the height of the upper edge of the window aperture from the gangway floor shall be at least 1500 mm in the rear saloon area for rear engine buses.

2.2.2.5 In case of Type I Midi and Mini NDX buses, the height of the upper edge of the window aperture from the gangway floor shall be at least 1300 mm for buses with standees provision and 1150 mm for buses with no standees provision

2.2.2.6 The minimum dimensions of window aperture in case of AC fitted buses shall be as follows.

	Min. Dimensions (mm)	
	Other than Midi & Mini	**Midi & Mini (AC fitted**

	(AC fitted buses)	buses)
Width	550	550
Height	700	450

2.2.2.7 However, these dimensions shall not be applicable to the following –

(i) Front & Rear corner side windows.

(ii) Any other window which forms a part of emergency exit.

(iii) Fixed for the purpose of maintaining the minimum window pitch in relation to the overall vehicle dimension.

(iv) The window (s) above route and destination box fitted at left side near the entrance, at eye level.

2.2.3 Guard Rail

2.2.3.1 All Type 1 buses except AC buses fitted with fixed or pasted glass shall be provided with minimum of two guard rails on the outer side. However, this requirement shall not be applicable for buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons."

Windows with sliding glass shall be fitted with guard rails. Fitment of guard rails on emergency windows is prohibited.

2.2.3.2 The first guard rail shall be provided at a height of 75 ±10 mm from the lower window sill.

2.2.3.3 The distance between two guard rails shall be 75 to 100 mm.

2.2.4 Emergency Exits

2.2.4.1 All Buses of Type I shall be provided with two emergency exits, out of which one shall be in the form of emergency door.

~~In case of standard buses, at least~~ One emergency exit in the form of emergency door shall be situated on the opposite side of the service door and, if the service door is located at :

i) Front half or middle then emergency door shall be located at middle of the bus or rear half of the bus.
ii) Rear half then emergency door shall be located at front half or middle of the bus.

In case of electric buses and buses with front engine, emergency door located at rear face of bus shall be permitted.

Emergency door shall meet the dimensional requirements given in para 2.2.4.13 and the technical requirements of para 3.4.5.1

2.2.4.2 Reserved

2.2.4.3 In case of, Midi and Mini Buses where the emergency door is provided on the opposite side of the service door, it shall meet the dimensional requirements given in para 2.2.4.13 and the technical requirements of para 3.4.5.1.

2.2.4.4 In case of , Midi and Mini Buses where the emergency exit is provided at the rear of the vehicle, its minimum dimensions shall be 1250mm x 550mm for emergency door exit (refer Cl.2.2.4.13) or 4000 cm^2 for emergency window exit (refer Cl. 2.2.4.15). The emergency door width may be reduced to 300 mm in cases where intruding wheel arches so require, providing that the width of 550 mm is respected at the minimum height of 400 mm above the lowest part of the door aperture and the upper corners may be reduced with round-offs, with a radius of not more than 150 mm.

2.2.4.5 In case of more than one emergency exit, one of the emergency exit shall be situated in the front half of the vehicle, on the side opposite to the service door and the second emergency exit shall be either on the rear half or at the rear side of the bus.

2.2.4.5.1 In case emergency door is situated on opposite side of the service door, emergency door shall be located in the rear half of vehicle, where in service door is provided near the front of the bus. Whereas, in case if service door is provided near to the rear of the bus, then emergency door shall be located in the front half of the vehicle. Alternatively emergency door can be provided at the center on the opposite side of the service door.

2.2.4.6 Windows of the vehicle may be considered as emergency exits provided they meet the minimum size given in para 2.2.4.15 and comply with technical requirements defined in para 3.4.5.2.

2.2.4.6.1 All the side wall windows fitted with breakable safety glass shall be designated as emergency windows. Designated emergency windows of breakable safety glass type shall be provided with breaking device properly fastened by suitable means like metallic chain, rope etc and shall be made easily identifiable with self-luminescent label or a lighting device.

2.2.4.6.2 For all buses with fixed windows as emergency exits, two additional breaking devices (hammers) to break open the safety glasses from outside by driver/co-driver shall be provided in the driver's cabin at a suitable location which should be easily accessible. Length of the handle of such breaking device shall be suitable to reach the centre of emergency window glass from outside.

2.2.4.7 Each rigid section of an articulated bus shall be considered as a separate unit and the connection between the two sections is not considered as an emergency exit.

2.2.4.8 A door provided in the rear face and not designated as a service door shall meet the requirements of emergency exit.

2.2.4.9 If the driver compartment does not provide access to the passenger compartment by means of a passageway, the following condition shall be met;

- The driver compartment shall have two exits, which shall not be on the same lateral wall; and one such exit is a window, it shall comply with the requirements set in para 2.2.4.15 and comply with the technical requirements defined in para 3.4.5.2.
- Where seats are permitted along side the driver for passenger seat, both exits shall be doors. The driver door shall be accepted as emergency exit for the passengers and the second exit provided shall be accepted as the

emergency exit for the driver, provided the driver controls, steering wheel, engine housing etc. do not constitute a serious obstruction.

2.2.4.10 If the driver compartment and seats adjacent to it are accessible from the main passenger compartment by means of a passage, no additional external exit mentioned in para 2.2.4.9 is required.

2.2.4.11 The fitment of any welded structure / frame restricting the opening of any of the emergency exit, from inside or outside the vehicle, shall not be permitted.

2.2.4.12 The minimum number of Emergency doors or Exits or apertures in case of other than Mini and Midi bus shall be as follows:

Category	NDX	SDX	DLX	ACX
	2	2	2	2

2.2.4.12.1 There shall be a minimum of one Emergency doors or Exits or apertures in case of a Mini & Midi Bus.

2.2.4.13 Minimum dimensions of the emergency exits shall be as below :

Category	Height (mm)	Width (mm)
	1250	550

2.2.4.14 For the purpose of this requirement, service doors equipped with power operated system shall not be deemed as emergency exits unless they can be readily opened by hand, once the control specified in technical requirements para 3.4.4.9.1 has been actuated if necessary.

2.2.4.15 Minimum requirements of the emergency windows shall be as below:

Category	Area (cm^2)	Remark
	4000	It shall be possible to inscribe in this area a 50 cm high and 70 cm wide rectangle.

2.2.4.16 Minimum one no. of escape hatch additional to the emergency doors and windows, shall be fitted in the roof for all type I buses.

This provision shall not be applicable for buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons and/or buses with overall length less than 7 meters.

2.2.4.16.1 Where escape hatches are provided the position shall be as specified below:

Number of Hatches	Position of the Hatches
One	Shall fall in the middle segment of the roof, when the entire roof is considered as three segments.
Two or more	Shall be separated by a distance of at least 2 m, when measured between the nearest edges of the aperture and in a line parallel with the longitudinal

	axis
Note : In case of buses accommodating CNG cylinders and AC units on the roof, escape hatche/s shall be positioned suitably."	

2.2.4.16.2 Minimum requirements of the escape hatches shall be as below:

Category	Area (cm^2)	Remark
Type I	4000	It shall be possible to inscribe in this area a 50 cm high and 70 cm wide rectangle.

2.2.4.17 In case of standard Type I buses, emergency exit having aperture dimensions in accordance with clause 2.2.4.13 or 2.2.4.15 shall be provided. This emergency exit shall be openable/breakable from both inside and outside of the bus.

2.2.5 Steps

2.2.5.1 Dimensions of Steps in mm shall be as given in the table below:

Classes		I
First step from ground 'D'	Max. height (mm)	400 (1)(2)
	Min. depth (mm)	300-(4)
Other steps 'E'	Max. height (mm)	250 (3)
	Min. height (mm)	120
	Min. depth (mm)	200
Ref Fig. 1		
(1) 700 mm (max.) in the case of an emergency door. 1500 mm in the case of an emergency door in the upper deck of a double deck vehicle.		
(2) 400 mm in the case of Type I bus with air suspension (both front and rear) and 430 mm in the case of mechanical suspension (both front and rear) or combination of mechanical and air suspension.		
(3) 300 mm in the case of steps at a door behind the rearmost axle.		
(4) 180 mm for vehicles having a capacity not exceeding 22 passengers.		
For differently abled passengers please refer Appendix V Clause No. 3.1: Steps		

Note:

1. At a double doorway the steps in each half of the access passage shall be treated separately.
2. E need not be the same for each step.

2.2.5.2 The height of the first step in relation to the ground shall be measured with the vehicle on level ground, unladen, the tyre pressure being as specified by

the manufacturer corresponding to maximum technical mass.

2.2.5.3 The height of a step shall be measured at the centre of its width.

2.2.5.4 Where there is more than one step, each step may extend into the area of the vertical projection of the next step by 100 mm and the projection over the tread below shall leave a free surface at least 200 mm with all steps edges designed to minimise the risk of tripping and being in contrasting colour or colours. A yellow colour band of 50 mm width shall be provided on all steps to assist visually impaired people.

2.2.5.5 A rectangular template of 400 mm x 200 mm (width X depth) when placed over the step shall have a contact area of at least 95 %, In case of a double doorway each half of the door shall fulfil this requirement.

2.2.5.6 All steps shall be provided with anti skid surface (Aluminium chequered plate/ grooved vinyl sheet or any non-slip coating). The anti skid surface shall meet the requirements specified in AIS standard as and when notified.

2.2.6 Access to Service Doors

2.2.6.1 The free space extending inward into the vehicle from the side wall in which the door is mounted shall permit the passage of vertical template 20 mm thick, 400 mm wide and 700 mm in height above the floor, having a second panel 550 mm wide superimposed symmetrically above it. The height of the second panel being as prescribed for the relevant type of vehicle. (Refer Figure 2).

2.2.6.2 The height of the second panel be as specified below. (Ref. Fig. 2)

	Dimensions in mm				
	Other than Midi bus and Mini Bus			**Midi bus and Mini Bus**	
				Standee	**Non Standee**
Width of upper panel	550			550	550
Height of upper panel (A) ** (2)	Type I	1100	1100 * (1)	950/950* (1)	700/950* (1)
Total height of dual panel ** (2)	Type I	1800		1650	1400

* (1) Alternate trapezoidal section having a height of 500mm, forming the transition between the width of the upper and the lower panel, may be used. In this case, the total height of the rectangle section and this trapezoidal section of the upper panel shall be 1100 mm for all types of vehicles other than Midi and Mini buses, and 950 mm for the Midi and Mini buses.

** (2) These dimensions shall be reduced by 100 mm for Mini Buses whose Gross Vehicle Weight is less than 3.5 tons.

2.2.7 Floor Height

2.2.7.1 The height of the floor measured in relation to the ground shall be measured with the vehicle unladen.

2.2.7.2 For purposes of determining the floor height, at least 35% of the area available for the standing passengers (or in its forward section in the case of articulated vehicles, or in its lower deck in case of double decker vehicles) form a single area without steps reached through at least one service door.

2.2.7.3 The floor height shall be measured at any one of the service doors of the vehicle in unladen condition. (reference point to be specified by the manufacturer)

2.2.8 Gangways

2.2.8.1 The gangway for all the vehicle categories shall be designed and constructed to allow free passage of a gauging device consisting of two coaxial cylinders with an inverted truncated cone interposed between them. The minimum dimensions (in mm) of the device shall be as mentioned below: (Ref. Fig. 3)

	Other than Midi and Mini Bus	**Midi and Mini Bus**	
	Type I	**Standee**	**Non Standee**
Diameter of the lower cylinder (A)	450	350	300
Height of lower cylinder	900	900	900
Diameter of the upper cylinder (C)	550	550	450
Height of upper cylinder (B)	500	500	300
Overall Internal height (H)	1900	1750	1500

2.2.8.2 On rear engine vehicles the height of the upper cylinder may be reduced by 150 mm in any part of gangway to -

- the rear of a transverse vertical plane situated 1500 mm forward of the centre line of the rear axle, and
- the rear of a transverse plane situated at the rear edge of the rearmost service door, if there are more than one service door.
- the front of a transverse vertical plane situated at the centre line of the front axle.

2.2.8.3 On Articulated buses the gauging devices defined in para 2.2.8.1, shall be able to pass unobstructed through the articulate section. No part of the soft covering including parts of bellow, shall project into the gangway.

2.2.8.4 Folding seats allowing passengers to sit in the passage shall not be permitted. Folding seats in the passage s\hall be allowed in the case of Mini buses whose

Gross vehicle Weight (GVW) is less than 3.5 tons.

Note : In case of differences between the specifications stated above and that of AIS-023, the specifications of AIS-023 shall be considered as final and standing.

2.2.8.5 Steps may be fitted in the gangway for access from low to high or high to low floor (excluding pedestal floor, wheel arch bays),provided -

- Height of the step is not less than 120 mm and not greater than 250 mm;
- Depth of the step is not less than 230 mm;
- Width of the step is same as the width of the gangway, at the top of the step

2.2.8.6 Gangways and access passages shall be covered/lined with an anti-slip material. The anti slip material shall meet the requirement of the relevant standard as and when notified.

2.2.8.7 The **slope of the gangway** with vehicle in the unladen condition and in the horizontal surface shall not exceed 8% :

2.2.9 Hand Rails and Hand Holds

2.2.9.1 Hand rails and hand holds shall meet AIS-046 requirement

2.2.9.2 They shall be designed and installed as to present no risk of injury to passengers. (There shall be no relative movement between the rail and mounting bracket)

2.2.9.3 Hand rails and hand holds section dimensions shall be such that the passengers can grasp them easily and firmly. Hand rail length shall be at least 100 mm to accommodate a hand or this requirement shall be in accordance with AIS-046, as amended from time to time.

2.2.9.4 Diameter of the section shall not be less than 20 mm and not more than 45 mm. Or this requirement for the diameter of the section shall be in accordance with AIS-046, as amended from time to time, `for the specifications of hand holds.

2.2.9.5 Reserved

2.2.9.6 The clearance between a hand rail or a handhold and adjacent part of the vehicle body or lateral wall shall be at least 40 mm. However in case of a handrail on a door or seat a minimum clearance of 35 mm shall be permitted. The lateral clearance shall be 150 mm minimum or this requirement shall be in accordance with AIS-046, as amended from time to time.

2.2.9.7 Handrails and /or handholds shall be provided with sufficient number for each point of the floor Area intended, for the standing passengers. This requirement shall be deemed to be full filled if at least two handrails and/ or handholds can be reached is inside the envelope inscribed by the moving arm of the testing device. The dimensions of the testing device are appended in Fig. 4. The

testing device is designed to rotate freely about its vertical axis.

2.2.9.8 Hand-rails and handholds above 800 mm and not greater than 1900 mm shall be considered to meet the above requirement.

2.2.9.9 For every position that can be occupied by a standing passenger, at least one of the two required Handrails or handholds shall not be more than 1500 mm above the level of the floor at that position.

2.2.9.10 Areas which are occupied by the standing passengers and are not separated by seats from the side walls or rear wall of the vehicle shall be provided with at least two horizontal handrails parallel to the walls and installed at a height between 800 mm and 1500 mm above the floor. The dimensions of the rail shall be as per para 2.2.9.4.

2.2.9.11 **Hand Rails and Hand Holds for Service Doors**

2.2.9.11.1 Door apertures shall be fitted with Hand Rails and/or Hand Holds on each side.

2.2.9.11.2 Handrails and Handholds provided for service doors shall be such that they include a grasping point available to a person standing on the ground and adjacent to the service door or any of the successive door steps. Such point shall be situated, vertically, between 800 to 1000mm above the ground or from the surface of each step, and horizontally,

a) For position appropriate to the person standing on the ground, not more than 400 mm inwards from the outer edge of the first step, and

b) For position appropriate to the particular step not more than 400 mm inward from the inboard edge of that step and not outwards from the outer edge of the step considered.

2.2.9.11.3 In case of a double door in the vehicle, no centre stanchion or hand rail shall be fitted for ultra-low floor buses.

2.2.10 Guarding of Stepwells

Where a seated passenger is likely to be thrown into a stepwell as a result of heavy braking, a 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 passenger who is prone to this risk or upto the edge of the riser of the innermost step, whichever is higher in dimension.

2.2.11 Seats

2.2.11.1 Seats shall be installed facing forward, rearward, or sideward or any combination provided that the requirements defined in AIS-023 shall be fulfilled. Side facing slip / foldable seats may be allowed in wheelchair area so that passengers may use the seat in case no wheelchair person boarded the bus. Priority shall be provided only for wheelchair person.

2.2.11.2 **Seat Layout**

	Other than Mini & Midi Bus				
Seat Lay out					**Mini & Midi bus**
	NDX	**SDX**	**DLX**	**ACX**	
2X1					✓* (1)
2X2	✓	✓	✓	✓	✓

* (1) In Midi & Mini buses, where it is not possible to meet the gangway requirements with 2X2 seat layout, the 2X1 seat layout may be provided.

Note : (i) In case of 2x1 ~~and 3x2~~ seat layout, the rows with lower number of seats shall be on service door side.

(ii) Seat layouts other than mentioned in aforesaid Table shall also be permitted provided that they meet AIS-023 requirements.

2.2.11.3 **Driver Seat / Co-Driver Seat**

Driver / Co-driver Seat shall comply with the requirements specified in AIS-023 – "Automotive Vehicles – Seats, their Anchorages & Head Restraints", as amended from time to time.

2.2.11.4 **Passenger Seats :**

2.2.11.4.1 **'Seat Width'** The minimum width of a seat cushion, measured from the vertical plane passing through the center of that seating position shall be as per AIS-023, as amended from time to time.

Ref. Fig. 5

Width of seat Cushion on each side In mm (F)	**NDX**	**SDX**	**DLX**	**ACX**
	200	200	200	200

2.2.11.4.2 **The minimum width of available space for each seating position (G):**

The minimum width of the available space for each seating position (G), measured from a vertical plane passing through the centre of that seating position between heights of 270 and 650 mm above the uncompressed seat cushion, shall be:

- 250 mm in the case of individual seats, and

- 225 mm in the case of continuous seats for two or more passengers.

Ref. Fig 5

For vehicles 2.35 m in width or less, the width of the available space for each seating position shall be 200 mm. Ref Fig. 5

For vehicles having a capacity not exceeding 22 passengers, in the case of seats adjacent to the wall of the vehicle, the available space does not include, in its upper part, a triangular area 20 mm wide by 100 mm high. In addition, the space needed for safety belts and their anchorages and for the sun visor should be considered as exempted.

For vehicles above 2.35 m and up to 2.6 m in width, with 3X2 seating layout, the minimum width of available space for each seating position (G) shall be 200mm.

2.2.11.4.3 T**he minimum backrest height (H):**

This is expressed as the vertical distance between the floor and the top of the seat or headrest. The dimension shall be as per AIS-023, as amended from time to time. Ref. Fig 5, Dimension H.

Type I	800 mm

2.2.11.4.4 Minimum armrest height from cushion (if provided): 175 mm. Ref. Fig 5

2.2.11.4.5 **Armrest width (if provided):**

The minimum Armrest width, wherever provided shall be 40 mm.

The Armrest could be either fixed or retractable. Ref. Fig 5

2.2.11.4.6 **Depth of seat cushion:**

The minimum depth of seat cushion shall be as follows (Ref. Fig. 6)

Depth of seat cushion in mm	**NDX**	**SDX**	**DLX**	**ACX**
	350	350	350	350

Note : In case of differences between the values specified above and that of AIS-023, the values specified in AIS-023 shall be considered as final and standing.

2.2.11.4.7 **Seat Spacing:**

2.2.11.4.7.1 The distance between the front of a seat squab and the back of a seat squab of the seat preceding it, shall when measured horizontally and at a height 620 mm from the floor shall not be less than following (in mm) :(Ref. Fig. 7)

	NDX	**SDX**	**DLX**	**ACX**
Type I	650	650	650	650

Note: In case of differences between the values specified above and that of AIS-023, the values specified in AIS-023 shall be considered as final and standing.

2.2.11.4.7.2 All measurements shall be taken, with the seat cushion and squab uncompressed in the vertical plane passing through the centerline of the individual seating space. (Ref. Fig. 7)

2.2.11.4.7.3 Reclining passenger seats shall be measured with the seat back in the normal position as specified by the manufacturer.

2.2.11.4.7.4 In case rearward clearance is provided, it shall continue upwards above the 100 mm level as an inclined plane and intersect the front edge of the seat structure immediately below the cushion.

2.2.11.4.7.5 For seat facing one another the minimum distance between the front faces of the seat squab of the facing seats, as measured across the highest points of the seat cushion shall not be less than 1300 mm.

2.2.11.4.8 **Seat base height (T) (Ref. Fig. 7)**

The height of the uncompressed seat cushion (T) i.e. the distance from the floor to the horizontal plane tangent to the front upper surface of the seat cushion shall be between 450$\pm$ 50 mm. This height may however be reduced to not less than 350 mm at the wheel arches and engine compartment.

2.2.11.4.9 **Minimum torso angle (α) (Ref. Fig. 8)**

NDX : 12^o

SDX, DLX and ACX : 15^o

DLX and ACX buses shall have adjustable reclining seats. Fitment of adjustable reclining seats shall be optional for Type I buses.

2.2.11.4.10 **Seat Base: -Thickness** The thickness of seat base in mm may be as follows: (Ref. Fig. 9)

	NDX	SDX	DLX	ACX
Thickness of seat cushion Front edge (min)	90	110	130	130
Thickness of seat cushion Rear edge (min)	60	80	100	100

Note: Incase buses are fitted with PPLD/LDPE seats, the seat cushion thickness shall be minimum 25 mm.

2.2.11.4.11 **Seat Back: - Thickness**

The thickness of seat cushion back in mm may be as follows :(Ref. Fig. 9.)

NDX	SDX	DLX	ACX
25	25	50	50

Note : Incase buses are fitted with PPLD/LDPE seats, the seat back rest thickness shall be minimum 10 mm.

2.2.11.4.12 **Clearance Leg Space for seated passengers:**

A minimum clear space in front of each passenger seat shall be provided as shown in Fig. 10. The seat back of another preceding seat or a partition whose contour correspond approximately to that of the inclined seat back may intrude into this space as provided by Para 2.2.11.4.7. The local presence of seat legs in this space shall also be permitted provided that adequate space remains for the passenger's feet. In the case of seats alongside the driver's seat in vehicle with up to 22 passengers, intrusion of the dashboard, instrument panel, windscreen, sun visor, seat belts and seat belt anchorages shall be allowed.

Note : In case of differences between the specifications mentioned above and that of AIS-023, the specifications given in AIS-023 shall be

considered as final and standing.

2.2.11.4.13 **Free height and Intrusion over seating position:**

2.2.11.4.13.1 **Free height over seating position (Head Room) (Ref. Fig. 11):**

Each seating position shall have free height of not less than 900 mm measured from the highest point of the uncompressed seat cushion. This free height shall extend over the vertical projection of the whole area of the seat and the associated foot space. However in the case of Mini Buses with Gross Vehicle weight (GVW) less than 3.5 tons, the free height shall not be less than 800 mm.

Note : In case of differences between the specifications mentioned above and that of AIS-023, the specifications given in AIS-023 shall be considered as final and standing.

2.2.11.4.13.2 **Intrusion over seating position (Ref. Fig. 11):**

In the space extending above the area mentioned in para 2.2.11.4.13.1, the following intrusions shall be permitted:

- Intrusion of the back of another seat;
- Intrusion of a structural member provided that the intrusion is

included within a triangle whose peak is situated 650 mm from the floor and whose base is 100 mm in width and situated in the upper part of the space in question, adjacent to the side wall of the vehicle

2.2.11.4.13.3 **Intrusion of Wheel arches (Ref. Fig. 11A & 11B):**

Wheel arch intrusion shall be permitted in the case of Mini buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons. However, in the case of a vehicle for upto 22 passengers excluding mini buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons, intrusion of wheel arch shall be permitted, provided that one of the following two conditions is fulfilled.

2.2.11.4.13.3.1 The intrusion does not extend beyond the median vertical plane of the seating position. Ref. Fig. 11A

2.2.11.4.13.3.2 The nearest edge of the area 300 mm in depth available for the feet of the seated passenger is advance no more than 200 mm from the edge of the uncompressed seat cushion and to not more than 600 mm in front of the squab of the seat , these measurements being made in the median vertical plane of the seating position. Ref. Fig. 11B. In the case of two seats facing each other this provision shall apply to only one of the seats and the remaining space for the feet of seated passengers must be at least 400 mm.

Note : In case of differences between the specifications stated above and that of AIS-023, the specifications of AIS-023 shall be considered as final and standing.

2.2.11.4.13.4 In the case of seats alongside the driver's seat in vehicles with up to 22 passengers, intrusion of hopper type windows when open and their fittings, of the dashboard / instrument panel, windscreen, sun visors, seat belts, seat belt anchorages and front dome.

2.2.12 Cabin Luggage Rack

2.2.12.1 The Cabin Luggage Rack shall be optional in Type I buses (Midi & Mini Buses). The minimum dimensions of the cabin luggage rack shall be as given below.

Width from Side wall (in mm)	250
Height from Roof (in mm)	200

2.2.12.2 The cabin luggage racks shall be designed in such away that the luggage is prevented from falling in the event of sudden braking or due to forces generated during cornering.

2.2.13 Luggage hold areas/compartments

2.2.13.1 No Roof luggage carriers shall be provided on any type of bus.

2.2.13.2 Luggage hold areas/compartments may be provided in form of Hat rack.

2.2.14 Reserved

2.2.15 Destination Board for Public Service Vehicles

2.2.15.1 Minimum of three destination boards shall be provided in Type I buses with at least one destination board each on front, rear and the service door side of the bus. However, in the case of Mini buses with Gross Vehicle Weight (GVW) less than 3.5 tons, at least two destination boards shall be provided.

2.2.15.2 LED destination boards, if fitted, shall comply with requirements specified in IS: 16490:2016, as amended from time to time.

2.2.15.3 The minimum dimensions of the destination board shall be as given below

Location	Height	Width	Mini and Midi buses	
	Type I,	Type I	Height	Width
Front	220	1200	200	800
Rear	220	900	200	800
Service Door Side	220	900	200	800

Note: The destination boards should be located in such a manner that they do not hit the heads of passengers while moving or while sitting. Also the front destination board should not hamper the driver's vision. If the rear wind screen is declared as emergency exit then the rear destination board should not hinder with the required area of emergency exit. Preferably, the destination boards should be accommodated in the structure of the bus so that no part of the destination board protrudes out and becomes a concern for passenger's safety.

2.2.15.4 The destination board shall be illuminated such that the whole of the destination board and the writing thereon are legible at a minimum distance of 30 metres.

2.2.15.5 CCTV System with and Integrated Emergency System for Buses

CCTV System, if fitted, shall be complying with the requirements specified in IS:16833:2018, as amended from time to time.

2.2.16 Driver's Work Area

Buses other than Midi and Mini Buses shall meet following driver work area requirements:

2.2.16.1 **Driver Entry and Exit**

2.2.16.1.1 **Driver Door (including Mini and Midi Buses)**

2.2.16.1.1.1 All buses shall be provided with a driver door.

2.2.16.1.1.2 Reserved

2.2.16.1.1.3 The minimum height of the driver door aperture, i.e., clear opening excluding handles, measured from the bus floor in the driver's area, shall not be less than 1250 mm high and 650 mm wide. In case of Midi and Mini buses, this dimension shall be 1050 mm high and 650 mm wide.

2.2.16.1.1.3.1 In case of Midi and Mini buses, if the structure, design or the operational use of the vehicle make it impossible to comply with requirements as specified in clause no. 2.2.16.1.1.3, the height and width of the driver door aperture excluding handles, measured from the bus floor in the driver's area, shall be minimum 1050 mm at its highest point and minimum 650 mm at its widest point respectively. The driver should be able to

ergonomically use the door opening for easy ingress and egress.

2.2.16.2 **Climb Facility**

2.2.16.2.1 The maximum height of first step from the ground shall be 550 mm.

2.2.16.2.2 The maximum height of other steps shall be 350 mm.

2.2.16.2.3 The maximum number of steps shall be four.

2.2.16.2.4 The minimum step width shall be 150 mm.

2.2.16.2.5 Minimum step depth shall be 150 mm.

2.2.16.2.6 The steps need be provided with anti-slip surface. The anti-slip surface shall comply with the relevant AIS standard as and when notified.

Note: The driver should be able to ergonomically use all the steps for climbing into the driver's cabin.

2.2.16.2.7 Dimensions specified in clauses 2.2.16.2.2. to 2.2.16.2.6 shall be made applicable in case of emergency exit steps.

2.2.16.3 **Hand Holds**

2.2.16.3.1 Driver door hand holds shall meet AIS-046 requirement

2.2.16.4 **Dimensional Requirement**

2.2.16.4.1 **Reference System for dimensions -** The intersection point (co-ordinate origin) of all the three planes corresponds to the vehicle projected at the heel point of the accelerator pedal. (Refer Fig. 13)

2.2.16.4.2 **Heel Point -** Heel point shall be located at a minimum distance of 340 mm from the inner face of the bulkhead. For this purpose the bulkhead is defined as a structure ahead of the heel point, supporting the front structure of the vehicle.

2.2.16.4.3 **Reference Point -** The "H" Point (Reference Point) shall be specified by the Chassis Manufacturer.

2.2.16.4.4 **Work area Dimension –**

2.2.16.4.4.1 The minimum width of the driver area from the right side wall shall be 800 mm, at a height of 900 mm from the heel point horizontal plane.

2.2.16.4.4.2 The minimum distance of driver partition from the driver seat shall be 25 mm from the rearmost point of the driver seat in its rearmost position with seat back reclined backwards to an angle of 12 degrees. (Refer dimension F in Fig. 14)

2.2.16.4.4.3 The minimum distance from H-point to roof top shall be 1060 mm. (Refer dimension D in Fig. 14)

2.2.16.4.4.4 The distance between the heel point and the H – point shall be between 600 mm to 640 mm. (Refer dimension A in Fig. 14)

2.2.16.4.4.5 The distance of H-point from floor shall be minimum 500 mm with the driver seat in the upper most position. (Refer dimension B in Fig. 14)

2.2.16.4.5 **Position of Steering Wheel**

2.2.16.4.5.1 The chassis manufacturer shall specify the position of the steering wheel with reference to the heel point.

2.2.16.4.5.2 The minimum distance of lower end of steering wheel from driver seat back shall be 350mm. (Refer dimension E in Fig. 14)

2.2.16.4.5.3 The thigh clearance of the steering wheel with driver seat in the upper most position shall be between 200 mm to 260 mm. (Refer dimension C in Fig. 14)

Note: Manufacturer may submit a drawing highlighting all dimensional requirements of this clause to Test Agency, for compliance to 2.2.16.4.

2.2.16.4.6 **Placement of Instrument Panel**

2.2.16.4.6.1 The placement of instrument panel shall be such that the primary instruments and controls are visible unobstructed while viewed from the driver seat. A typical driver information layout is shown in Fig. 15.

2.2.16.4.6.2 The dashboard shall be of non metallic, fire resistant, energy absorbing material and so constructed that in the event of a collision it shall cause minimum injury to the driver.

2.2.16.4.7 **Shroud for Wiring Harness**

2.2.16.4.7.1 A suitable non metallic, fire resistant, energy absorbing cover shall be provided for the wiring harness and other exposed parts below the instrument panel. The cover shall be so constructed that in the event of a collision it shall cause minimum injury to the driver.

2.2.16.4.8 **Position of Controls**

2.2.16.4.8.1 The position of the controls such as accelerator, clutch, gear lever, service brake, parking brake etc. shall be specified by the vehicle manufacturers.

2.2.16.4.9 **Heating, Cooling & Ventilation for Driver**

2.2.16.4.9.1 The driver's work area shall be provided with the blowers or other suitable devices to ensure proper ventilation. These devices shall be capable of minimum of three air changes per minute or as per standard whenever notified.

2.2.17 Standee Passenger Area

The capacity of standee passengers to be allowed in a bus will be governed on the basis of free bus floor area available for standee passengers (Asp)

by calculating at the rate of six standee passengers per Sq. Metre. the surface area "Asp" available for standee passengers will be calculated after deducting the following from the total floor area of the vehicle :-

I. The area of driver's compartment i.e. the space intended for driver's exclusive use and containing the driver's seat, the steering wheel, control, instruments and other devices necessary for driving or operating the vehicle.

II. The area of steps at door and the area of any other step with a depth of less than 30 cms. and the area swept by the door and its mechanism when it is operated.

III. The area of any part over which the vertical clearance is less than 135 cms. e.g. above wheel arch and above the engine, measured from the floor, according to the specified method and disregarding permitted intrusion.

IV. The area of any part of the vehicle to which access to passengers to be prevented for safety or any other reasons e.g. space available on both sides of the driver.

V. The area of floor space reserved solely for carriage of goods and luggage and from which passengers are excluded.

VI. the floor area occupied by any staircase in the vehicle

VII. The area of all parts which are not accessible to a standee passenger.

VIII. The area 30cms. in front of any seat.

IX. The area of all parts where the clear height above the floor is less than 190 cms. or in the case of the section of the gangway situated above and behind the rear axle, and attaching parts thereof, less than 180 cms. (excluding the hand – holds in this case).

X. The area forward of a vertical plane passing through the centre of the seating surface of the drivers seat (in its rear – most position) and through the centre of the exterior rear – view mirror mounted on the opposite side of the vehicle.

XI. Any part of the surface of the floor (e.g. a corner or edge) on which it is not possible to place any part of the rectangle of 400 mm x 300 mm.

XII. Any surface area which is not capable of circumscribing a rectangle of 400 mm x 300 mm. the vehicle.

XIII. The bus floor space of 150mm width along the bus gangway for facilitating movement of the passengers / conductor.

XIV. The area of all parts of the bus floor in which the slope exceeds the maximum permissible value as prescribed in clause 2.2.8.7.

2.2.18 Design Seating and Standee Passenger Capacities

2.2.18.1 The design seating capacity of a bus shall be calculated based on the seat layout and seat spacing as given in the table below.

Category	Seat Layout	Seat Width (in mm)	Seat spacing (in mm)
NDX	2x2	400	650
SDX	2x2	400	650
DLX	2x2	400	650
ACX	2x2	400	650

Note :

(1) The seat layout could be at the option of the bus builder , subject to the maximum seat layout specified in the table above and accordingly the seating area may be computed based on the above table information.

(2) In case of Mini & Midi bus where it is not possible to meet gangway requirement with 2x2 seat layout, 2x1 seat layout may be used for the purpose of calculating the seating capacity.

(3) In case of differences between the values specified above that of AIS-023, the specifications of AIS-023 shall be considered as final and standing.

2.2.18.2 The minimum gangway width for the calculation shall be as given in para 2.2.8.1.

2.2.18.3 The seating and standee passenger capacities shall be indicated in the Type Approval certificate for the bus body design.

2.2.18.4 Formula for calculation of seating and standee passenger areas –

Dimension	Description	Area (in mm^2)
Area of the Driver Compartment	Width x Depth of Driver Work Area	**Ad**
Total projected Step Well Area (all stepwells)	Sum of projected Area of all Step Wells	**As**
Projected area of Engine	Width x Length of Engine projected on the floor Area	**Ae**
Area of any part of the Vehicle where vertical	-	**Aw**

clearance is less than 1350 mm (Engine etc.)		
Area required to provide a clear work area at service floor area occupied by any stair case	-	**Ast**
Area of parts where clear height above floor level less than 1900 mm (1750mm in case of mini bus)	-	**Ac**
Area of seat in facing partition	(300 mm x Total seat width)	**Ap**
Area of the parts where slope exceeds the maximum specified value for purpose of passengers	-	**Asl**
Total Area excluded for purpose of calculating seated passenger capacity	Sum (Ad+As+Ae+Aw+Ag+Ast+Ap)	**Aex**
Area of Gangway	-	**Ag**
Total internal Floor Area	Internal Width x Internal Length	**Aint**
Area for seated Passengers	Aint-Aex	**Apass**
Area for standee passengers	Ag – (Ac + Asl + 150mm x Length of Gangway)	**Astd**

Note : Value of Astd is the solution of following three equations –

Aex = Ad + As + Ae + Aw + Asl + Ag + Ast + Ap

Apass = Aint – (Aex + Ag)

Astd = Aint – (Ad + As + Ae + Aw + Ast + Ac + Ap + Asl + Apass + 150mm x Length of Gangway)

2.2.18.5 Formula for calculation of number of seats and number of standees permitted.

Seating Capacity

a	No. of Seats accommodated with respect to space available in bus	A_{pass} / (seat Spacing X seat width)

b	No. of seats accommodated with respect to payload* (1)	
c	Seating Capacity (Lowest of a and b)	

Standee Capacity

a1	No. of Standee accommodated with respect to space available in bus	A_{std} X 6 X 10^{-6}
b1	No. of standee accommodated with respect to payload ((Payload/75) – c)	
c1	Standee Capacity (lowest of a1 and b1)	
* (1) Pay load for single passenger shall be 75 Kg (68 Kg Person's weight+ 7Kg Weight).		

2.2.19 Provisions for Differently Abled Passengers

2.2.19.1 All Type I buses shall have at least two passenger seats in case of Mini & Midi buses and four passenger seats in case of other buses designated as priority seats for persons with disabilities. These seats shall be only of the forward-facing type and preferably be located behind the driver's seat.

2.2.19.2 The seats designated for Differently Abled Passengers shall be indicated with appropriate sign(s). An illustration of the signs to be provided above the priority seats is shown in Figure 16.

2.2.19.3 The priority seats shall be provided with appropriate facility for securing the crutches, canes, walkers etc. to facilitate convenient travel for persons with disabilities.

2.2.19.4 Handrails and / or stanchions shall be provided at the entrance of all ~~Type I~~ buses in a configuration, which allows persons with disabilities to grasp such assists from outside the vehicle while starting to board, and to continue using such assists throughout the boarding process, until they reach the designated seating area. The dimensions of the hand rails shall be as per para 2.2.9.

2.2.19.5 All NDX buses shall be provided with controls adjacent to priority seats for requesting stops and which alerts the driver that a mobility aid user wishes to disembark. Such a system shall provide auditory and visual indications that the request has been made. Controls shall be mounted not higher than 1300 mm and now lower than 410 mm above the floor, shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls shall not be greater than 2.2 kg.

2.2.19.6 All Type I buses irrespective of floor height shall be accessible for people with reduced mobility including at least one wheel chair user according to the technical provisions laid down in Appendix V. However, wheelchair accommodation provisions shall not be applicable for buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons and/or buses with overall length less than 7 meters.

2.2.20 Side Underrun Protection

2.2.20.1 The requirements of Side under run protection shall be in accordance with IS-14682:2004, as amended from time to time.

2.2.21 Rear Underrun Protection

2.2.21.1 The requirements of Rear Under run Protection shall be in accordance with IS-14812:2004, as amended from time to time.

2.2.23 External Projections:

2.2.23.1 The requirements of external projections shall be in accordance with IS: 13942 - 1994, as amended from time to time and as notified under Rule 124 of the Central Motor Vehicles Rules, 1989.

2.2.24 Interior Fittings:

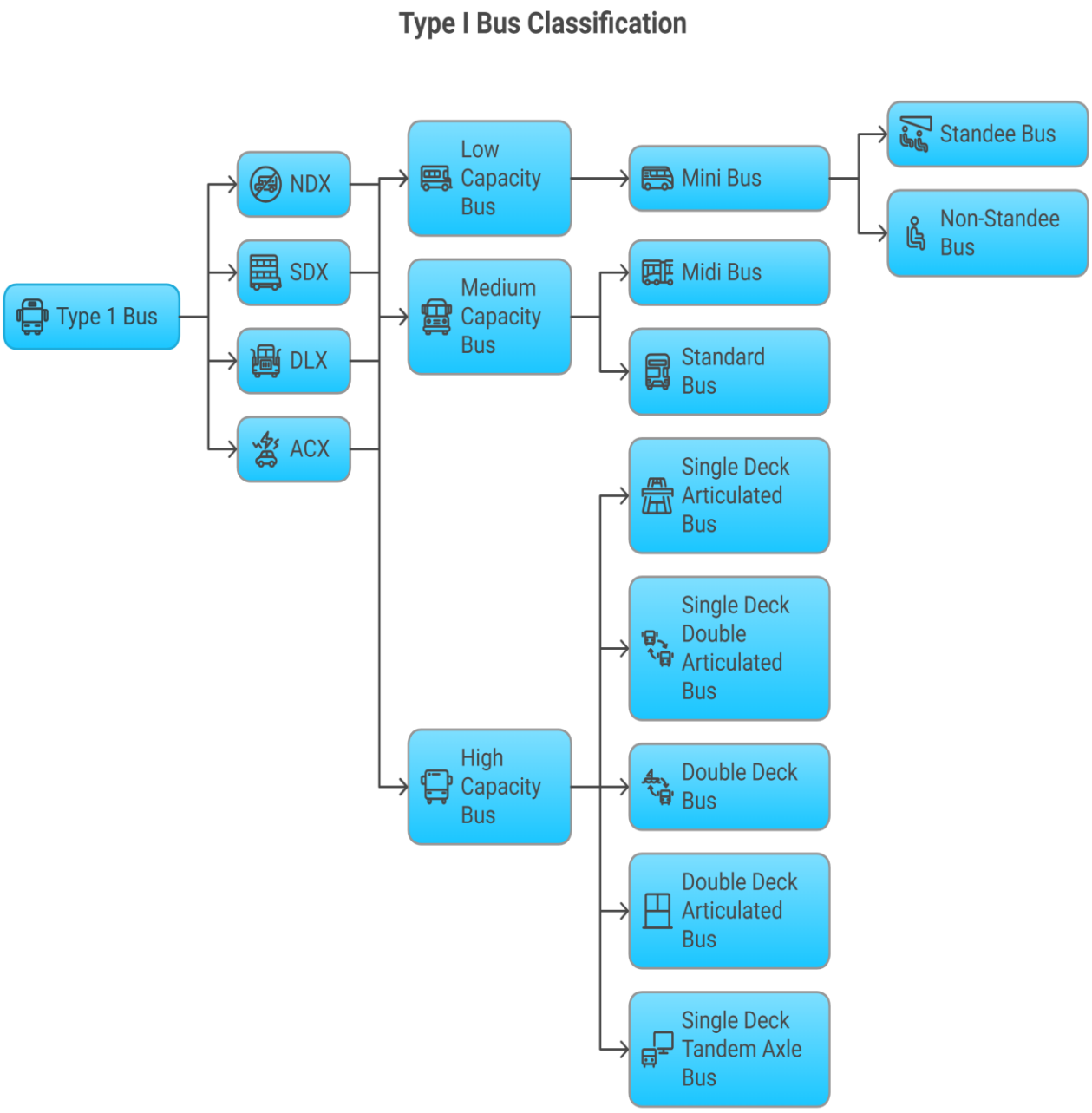
2.2.24.1 The requirements of interior fittings shall be in accordance with AIS-047, as amended from time to time and as notified under Rule 124 of the Central Motor Vehicles Rules, 1989.

2.2.25 Public Information System

2.2.25.1 All Type I, public service buses shall be provided with Audio / Visual or Audio-Visual Information System permitting driver or recorded or digitized human speech / visual messages, to inform passengers inside the bus regarding emergency escape provisions, destination, bus stops etc. This arrangement will enhance passenger safety.

2.2.25.2 All Type I, public service buses shall be provided with a emergency declaration switch to be operated by the driver / co-driver. This switch should activate a Audio hooter and Visual red blinking light inside and amber light outside the bus to declare an emergency for speedy evacuation of the passengers.

ANNEXURE 1 (See 2.0)



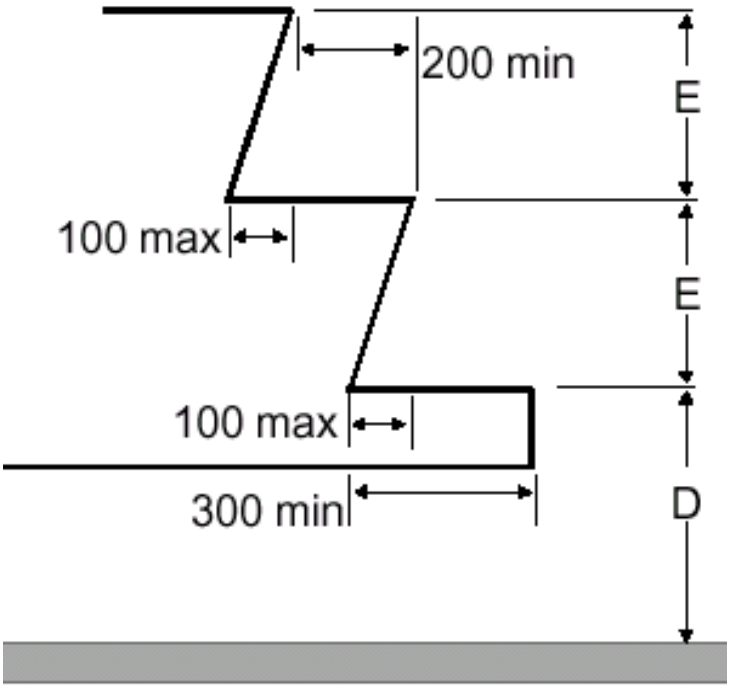


Figure 1
Steps

First step from ground 'D'	Max. height (mm)	400 (1)(2)
	Min. depth (mm)	300(4)
Other steps 'E'	Max. height (mm)	250 (3)
	Min. height (mm)	120
	Min. depth (mm)	200
	(1) 700 mm (max) in the case of an emergency door. 1500 mm in the case of an emergency door in the upper deck of a double deck vehicle.	
	(2) 400 mm in the case of Type I bus with air suspension (both front and rear) and 430 mm in the case of mechanical suspension (both front and rear) or combination of mechanical and air suspension.	
	(3) 300 mm in the case of steps at a door behind the rearmost axle.	
	(4) 180 mm for vehicles having a capacity not exceeding 22 passengers.	
	Note: 1. At a double doorway the steps in each half of the access passage shall be treated separately.	

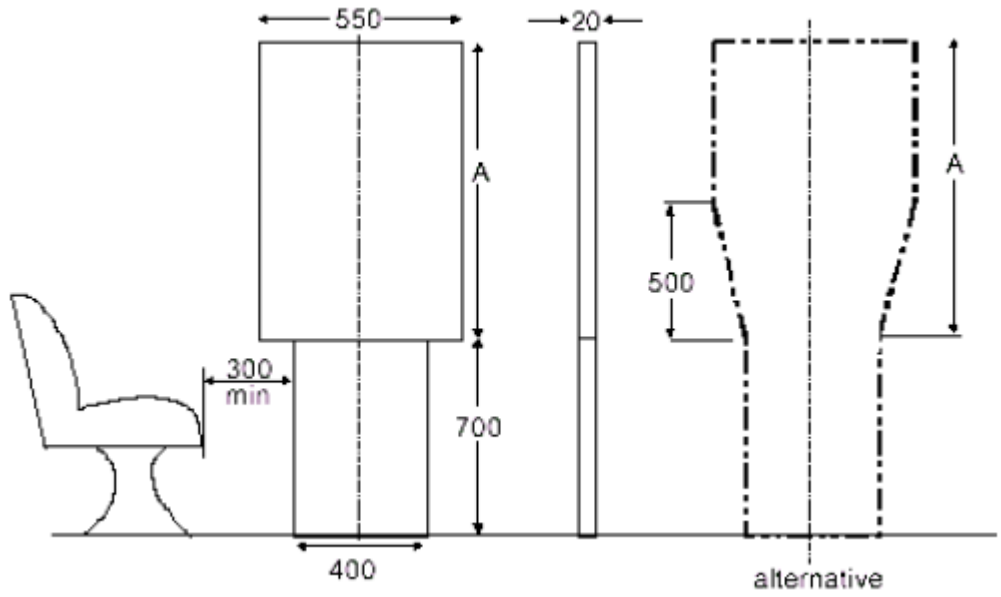


Figure 2

Access to Service Doors

	Dimensions in mm			
	Other than Midi and Mini Bus		**Midi and Mini bus**	
			Standee	**Standee**
Width of upper panel	550		550	550
Height of upper panel (A)	1100	1100*	950/950*	700/950*
Total height of dual panel	1800		1650	1400

* Alternate trapezoidal section having a height of 500mm, forming the transition between the width of the upper and the lower panel, may be used. In this case, the total height of the rectangle section and this trapezoidal section of the upper panel shall be 1100 mm for all types of vehicles other than Midi and Mini buses, and 950 mm for Midi and Mini buses.

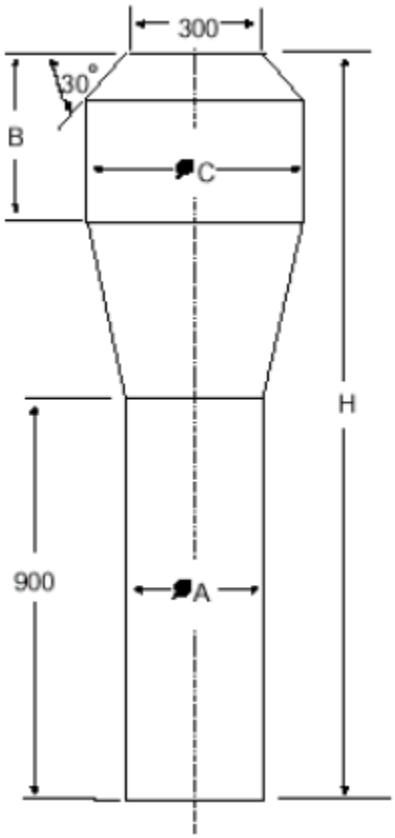


Figure 3

Gangways

	Other than Midi and Mini Bus	**Midi and Mini Bus**	
		Standee	**Non Standee**
Diameter of the lower cylinder(A)	450	350	300
Height of lower cylinder	900	900	900
Diameter of the upper cylinder(C)	550	550	450
Height of upper cylinder(B)	500	500	300
Overall Internal height(H)	1900	1750	1500

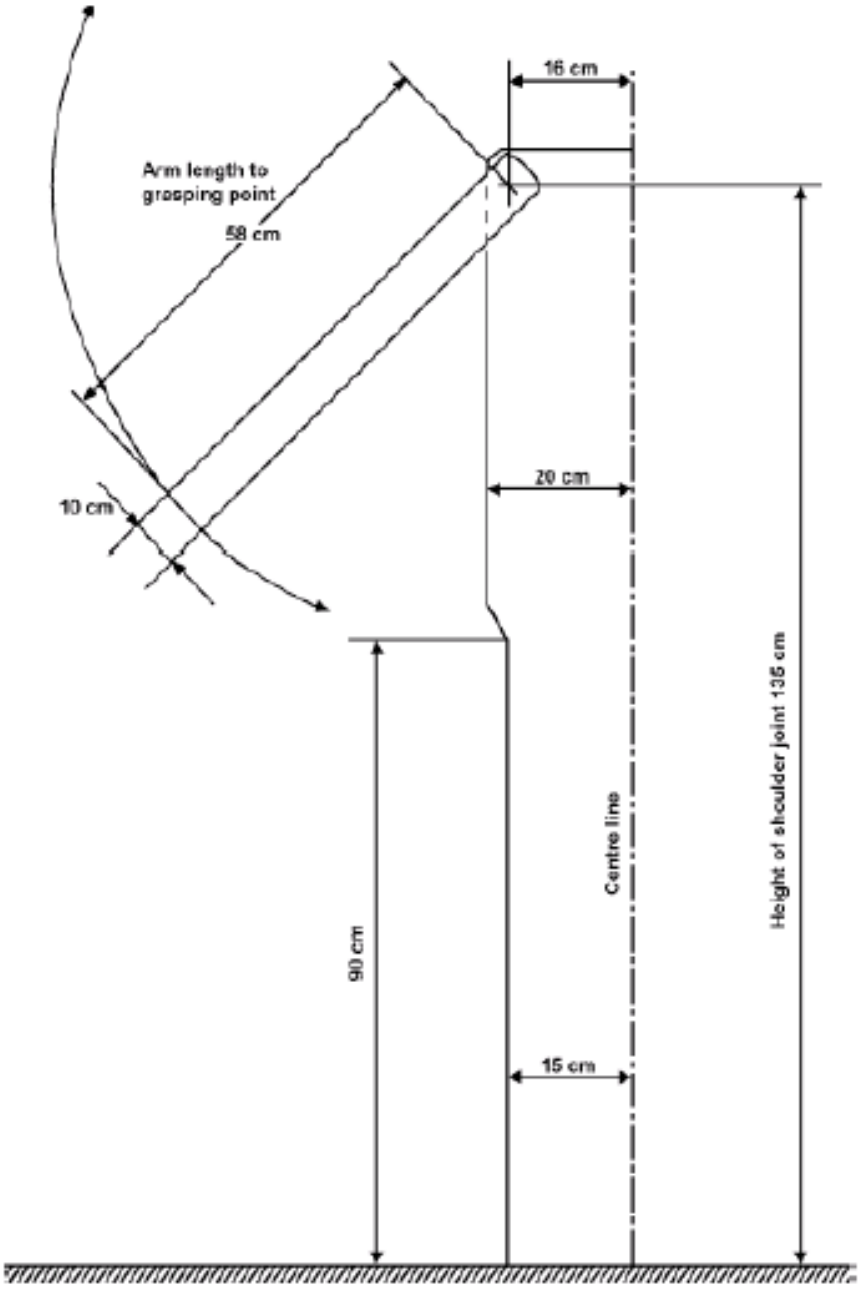


Figure 4

Siting of Hand Holds – Testing of Hand Holds

Figure 5

Reserved

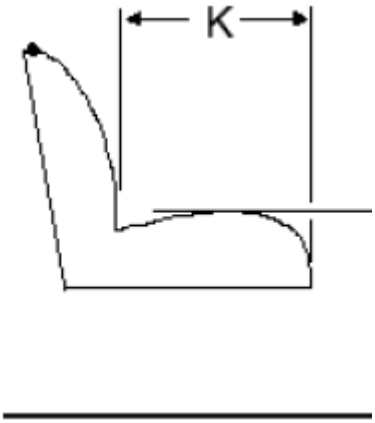


Figure 6
Depth of Seat Cushion

The minimum depth of seat cushion shall be as follows:

	Type I			
Depth of seat cushion,(K) in mm	**NDX**	**SDX**	**DLX**	**ACX**
	350	350	350	350

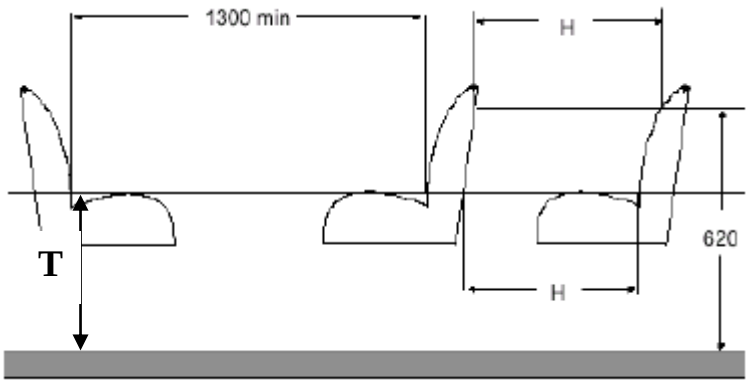
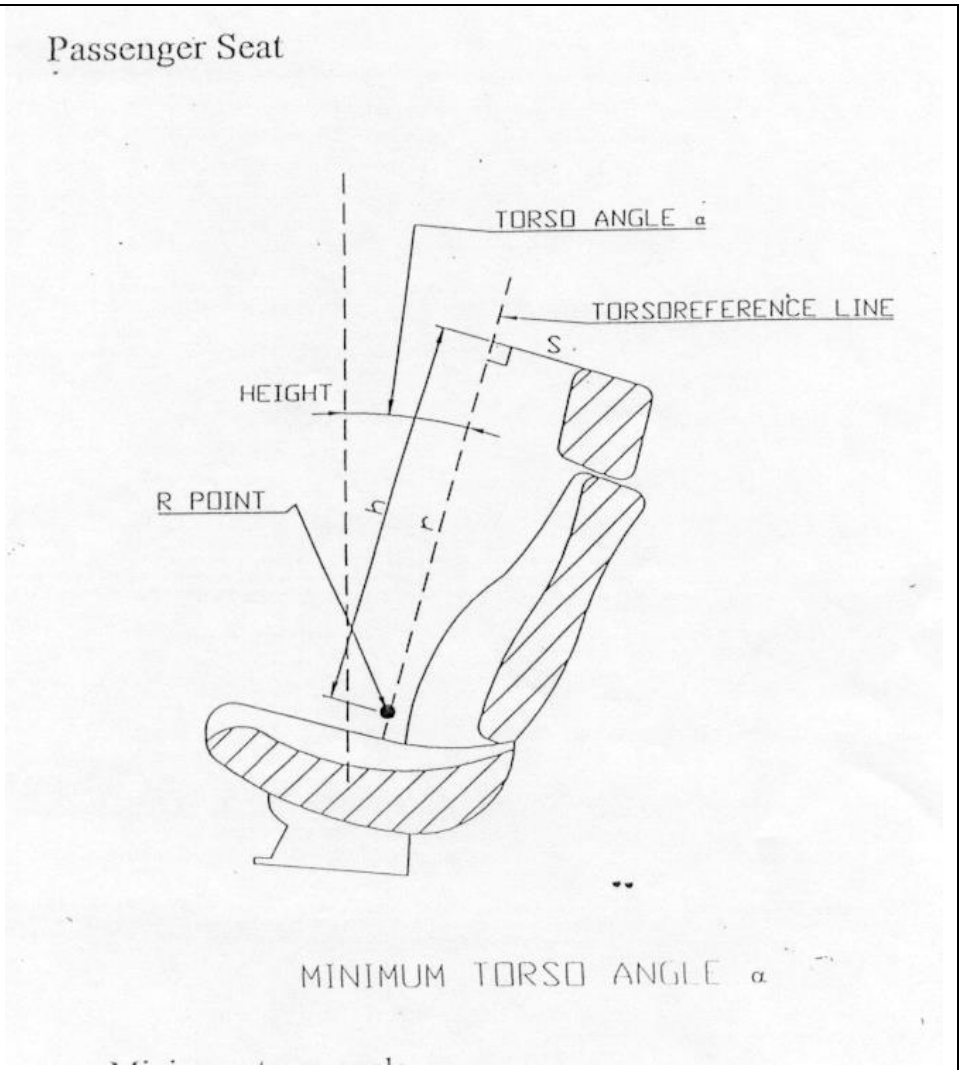


Figure 7
Seat Spacing

	NDX	**SDX**	**DLX**	**ACX**
Type I	650	650	650	650

	
	Figure 8 **Passenger seat torso angle**
	Minimum torso angle
	NDX : 12 deg. SDX, DLX & ACX : 15 deg.

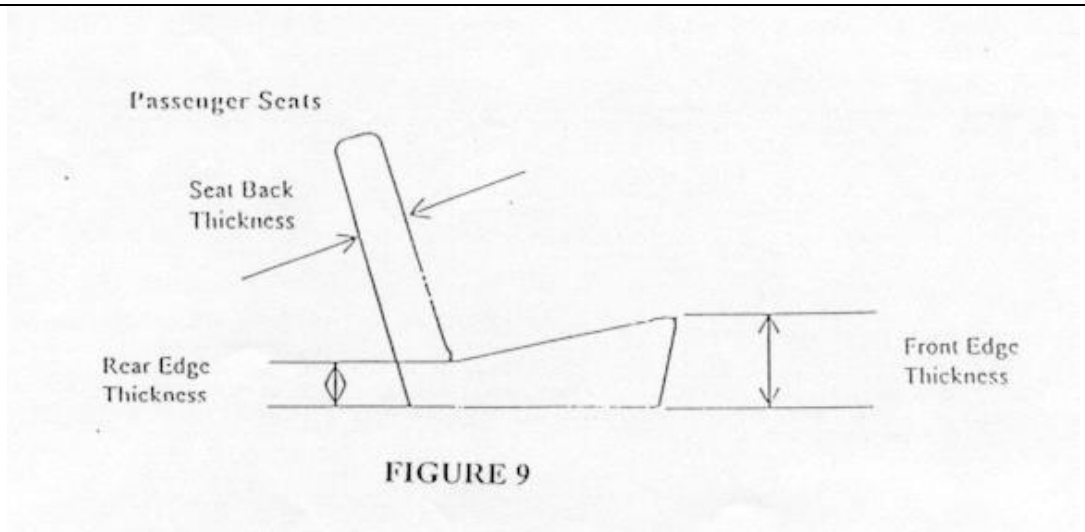


FIGURE 9

Seat Base Thickness

The thickness of seat base in mm may be as follows:

	NDX	SDX	DLX	ACX
Thickness of seat cushion front edge (min)	90	110	130	130
Thickness of seat cushion Rear edge (min)	60	80	100	100

Seat Back Thickness

The thickness of seat cushion back in mm may be as follows:

NDX	SDX	DLX	ACX
25	25	50	50

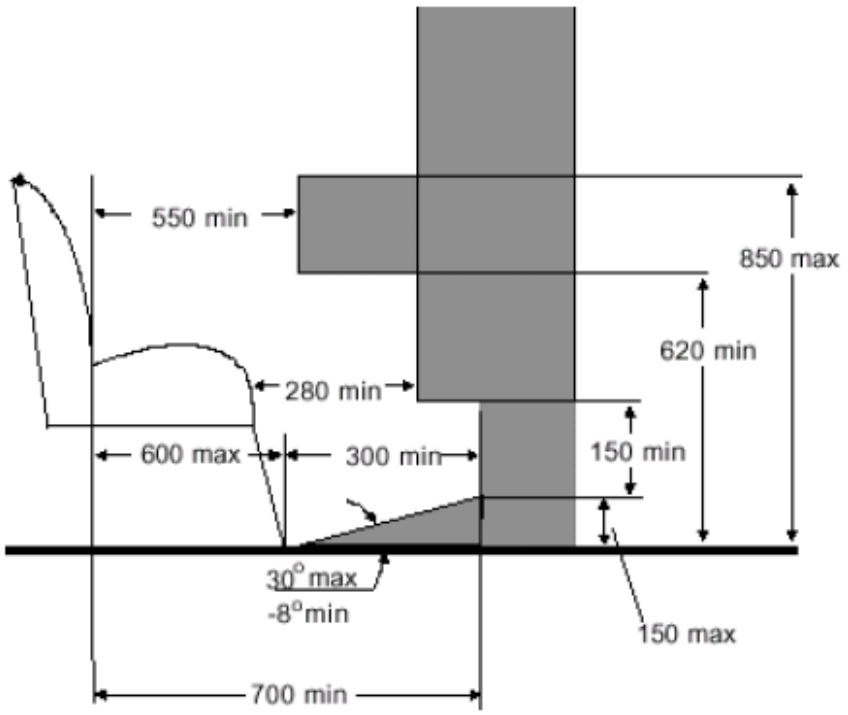


Figure 10
Passenger Seat Space for Seated Passenger

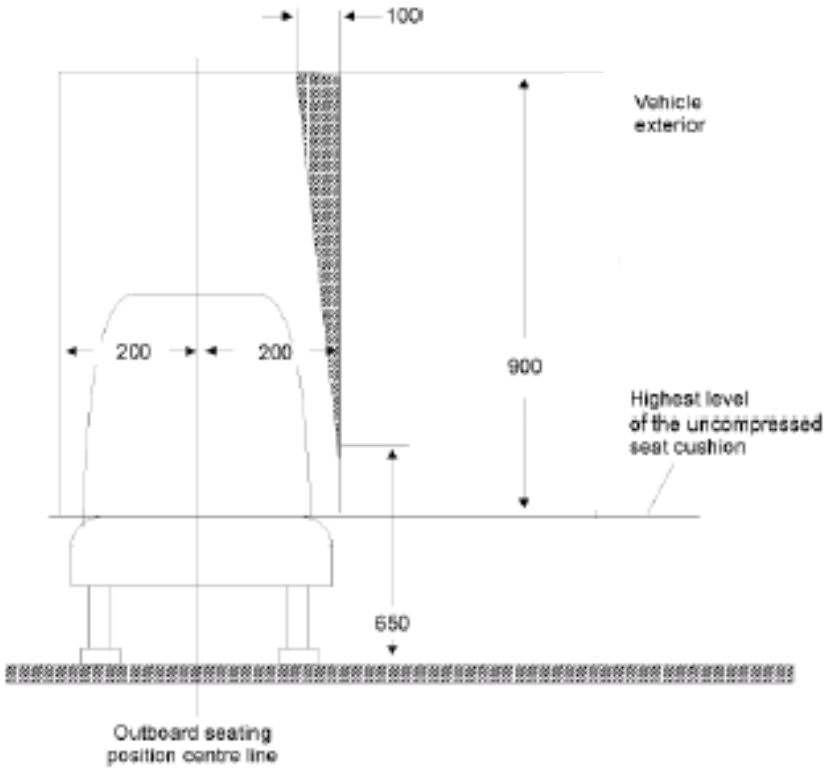


Figure 11

Permitted Intrusion above Seating Position

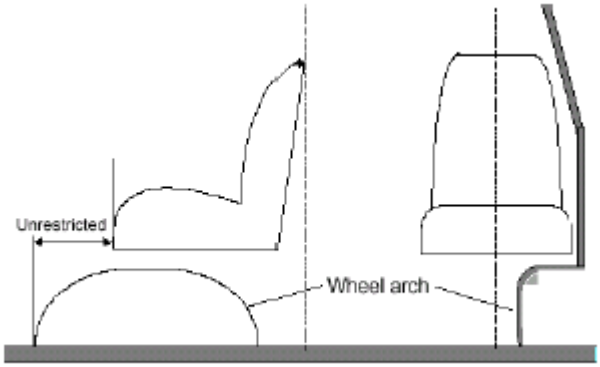


Figure 11A

Permitted Intrusion of a Wheel Arch not extending beyond the vertical centre line of the side seat

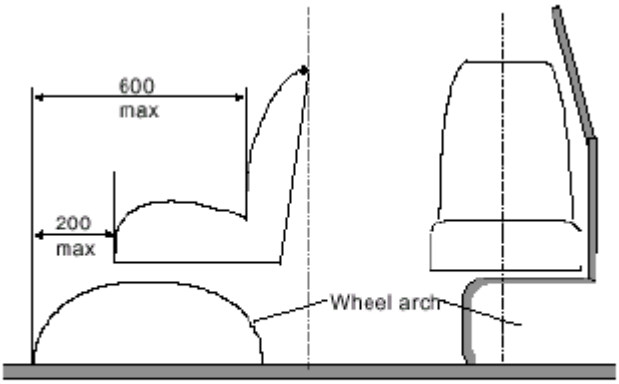


Figure 11B

Permitted Intrusion of a Wheel Arch extending beyond the vertical centre line of the side seat

Figure 12

Reserve

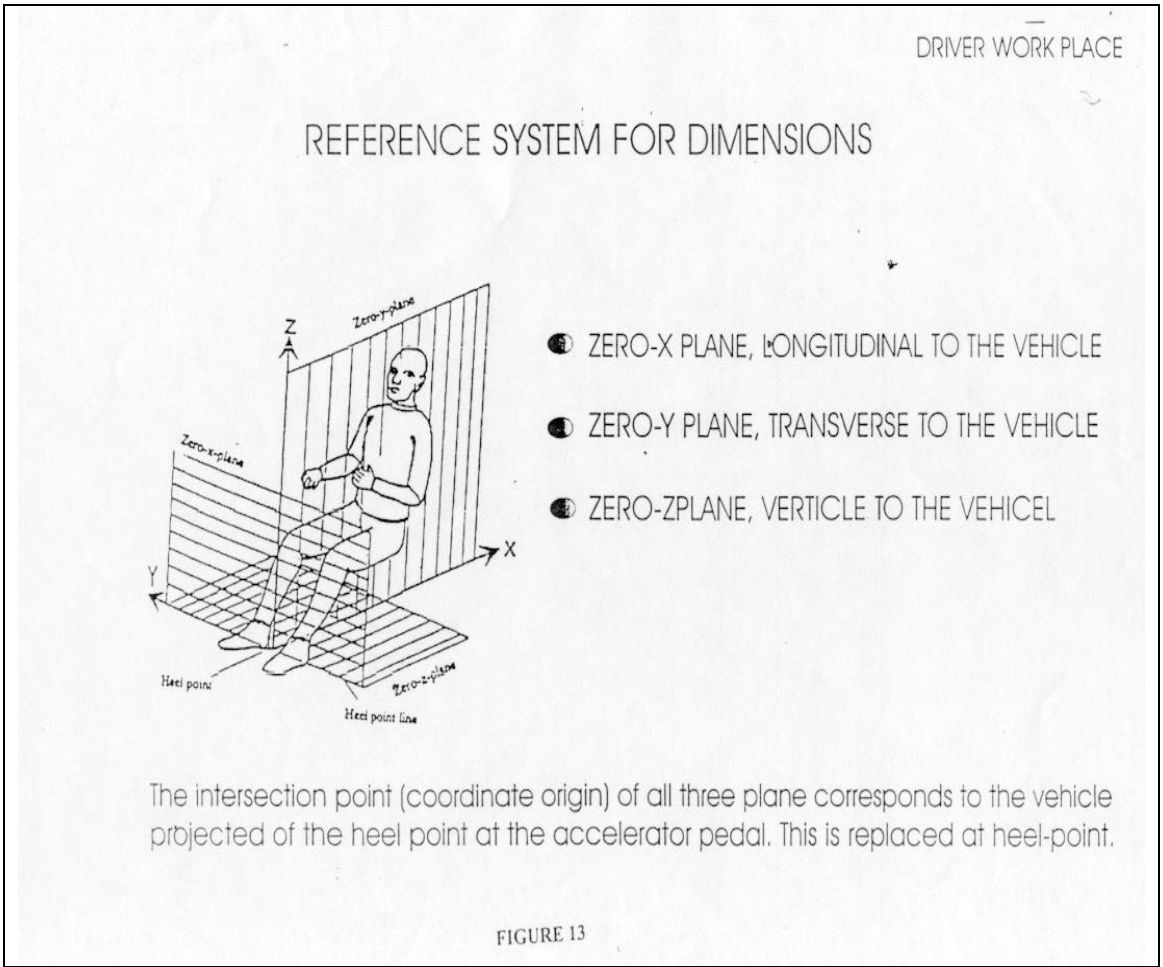
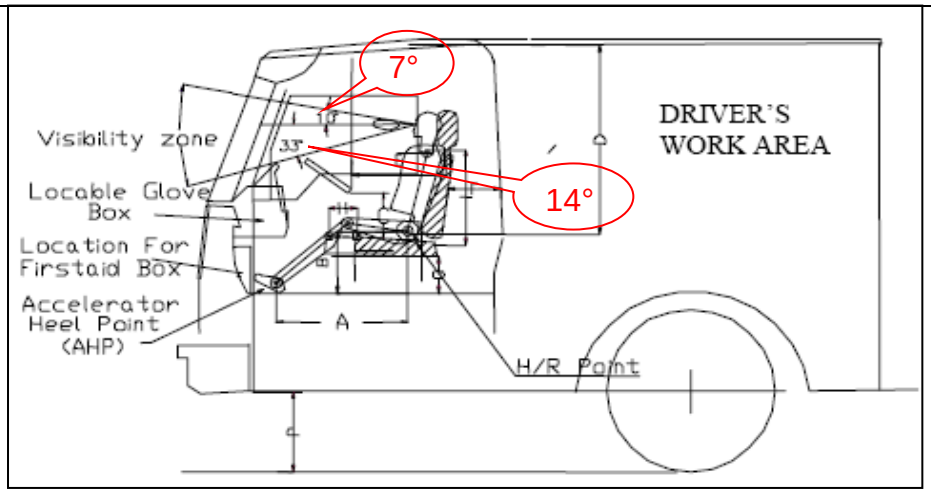

DRIVER WORK PLACE
REFERENCE SYSTEM FOR DIMENSIONS
Z
Zero-y-plane
Zero-x-plane
X
Y
Heel point
Zero-z-plane
Heel point line
ZERO-X PLANE, LONGITUDINAL TO THE VEHICLE
ZERO-Y PLANE, TRANSVERSE TO THE VEHICLE
ZERO-ZPLANE, VERTICLE TO THE VEHICEL
The intersection point (coordinate origin) of all three plane corresponds to the vehicle projected of the heel point at the accelerator pedal. This is replaced at heel-point.
FIGURE 13

Figure 13



Dimensional Requirement

A	Distance from Heel Point to "H" Point	600 mm to 640 mm
B	Minimum Distance from floor to "H" Point with the driver's seat in the upper most position	500 mm
C	Thigh Clearance	200 mm to 260 mm
D	Minimum Distance from "H" Point to Roof top	1060 mm
E	Minimum Distance from the lower end of steering to the front of driver's seat back rest	350 mm
F	Minimum Distance of driver's partition from the rear of the driver's seat with the driver's seat in the rear most position	25 mm

Figure 14

Driver's Work Area Requirements

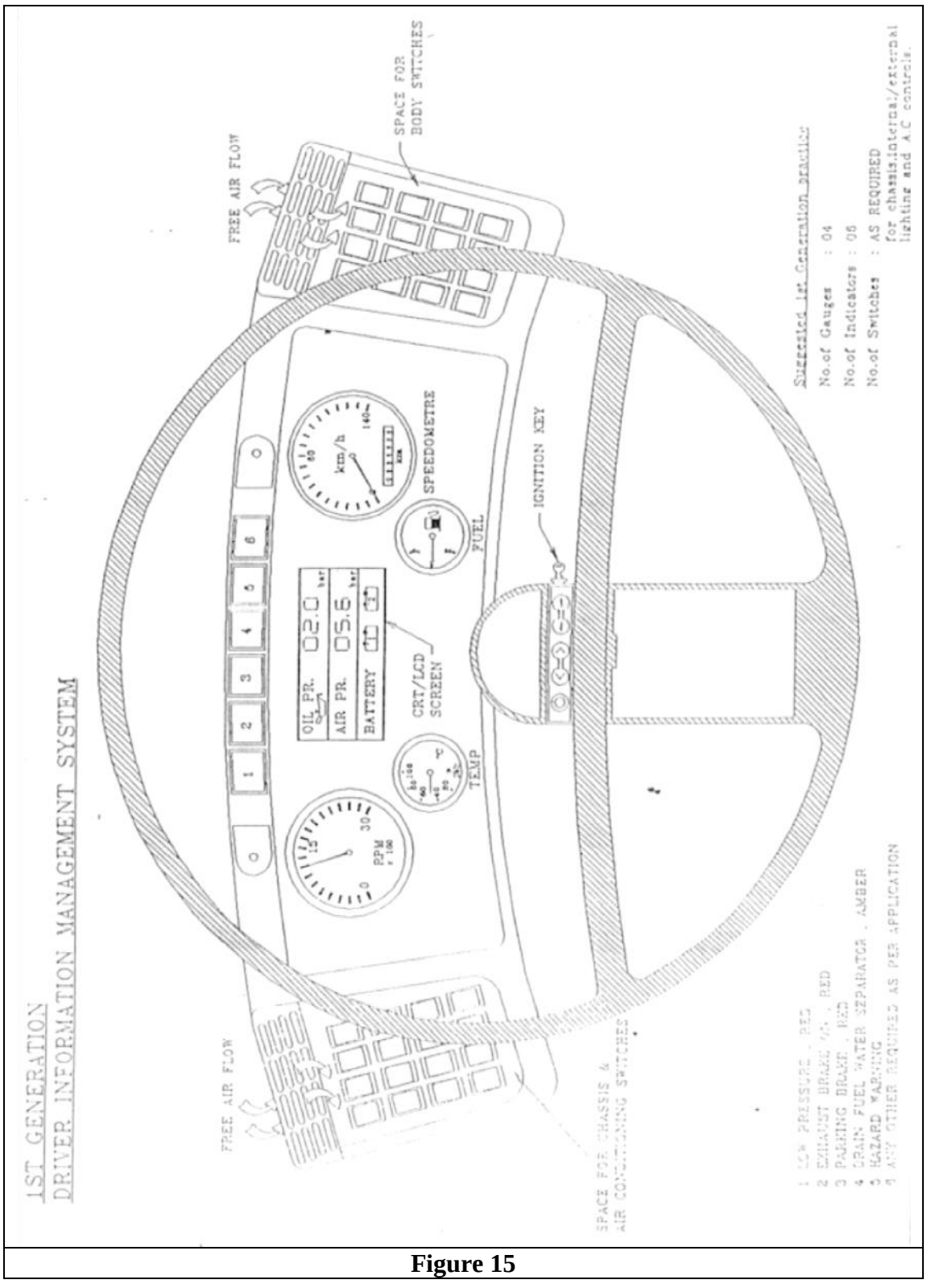

1ST GENERATION
DRIVER INFORMATION MANAGEMENT SYSTEM
FREE AIR FLOW
SPACE FOR BODY SWITCHES
SPEEDOMETRE
IGNITION KEY
FUEL
TEMP
CRT/LCD SCREEN
OIL PR.
AIR PR.
BATTERY
FREE AIR FLOW
SPACE FOR CHASSIS & AIR CONDITIONING SWITCHES
Suggested 1st Generation practice
No.of Gauges : 04
No.of Indicators : 06
No.of Switches : AS REQUIRED
for chassis/external lighting and A.C controls.

Figure 15

Figure 16
Pictogram for Passengers with Reduced Mobility

CHAPTER: 3

TECHNICAL & SAFETY REQUIREMENTS

3.1 Reserved

3.2 Body Structure Stability

Stability Test of the body structure of single as well as double deck vehicles of categories Type I shall meet the requirements test defined in Chapter 6, para 6.2.

3.3 Reserved

3.4 Doors

3.4.1 The structure of the door shall be able to withstand distortion due to forces induced during its operation and the operability of door components critical to the removal of the passengers after an accident shall be ensured.

3.4.2 The external side of the door shall not have any projection. The hinges and door handles shall meet requirements as specified in IS13942:1994, as amended from time to time.

3.4.3 Door shall be fitted with weather resistant EPDM rubber seals of suitable design to avoid dust and water ingress.

3.4.4 **Service doors**

3.4.4.1 All Type I buses, except NDX shall be provided with Power Operated Service Door(s). The Power Operated Service Door shall be optional in the Type I NDX buses.

3.4.4.2 Service door shall be capable of being easily opened from inside and from outside the vehicle when the vehicle is stationary. However this requirement does not preclude the possibility of locking the door from the outside, provided the door can be always opened from inside.

3.4.4.3 The control or device for opening a service door from the outside shall be located at a height of 1000 mm to 1500 mm from the ground level. The measurement shall be carried out in the unladen condition on level surface

3.4.4.4 Single piece manually operated service door which is hinged or pivoted shall be such that in the event the open door comes in contact with a external object while the vehicle is in forward motion the door shall tend to close

3.4.4.5 Where direct view is not adequate, optical or other devices shall be installed to enable the driver to detect from his seat the presence of a passenger in the immediate interior or exterior vicinity of every service door.

3.4.4.6 Manually operated service doors fitted with slam type lock shall be of the two stage type.

3.4.4.7 On the inside of a service door there shall not be any device intended to cover the inside steps when the door is closed. The door operating mechanism and other equipment attached to the inside door should not pose safety hazard for the passengers.

3.4.4.8 For every door which opens inwards, the mechanism shall be so constructed that its movement is not likely to cause injury to the passengers during normal use. Where necessary suitable protection devices may be provided.

3.4.4.9 **Additional Requirements for Power Operated Service Doors**

3.4.4.9.1 In the event of an emergency every power operated door shall be capable of

- being opened from inside when the vehicle is stationary even when locked from outside, by controls with or without power supply by which the door normally operates.
- Overriding all the other door controls.
- Being operated by a single person easily by hand.
- The controls shall be easily seen and identified by a person approaching the door or standing in Front of the door.
- The interior controls are placed on or within 300 mm of the door, at a height not less than 1,000 mm above the first step.

3.4.4.9.2 The construction and control system of every power operated service door be such that a passenger is unlikely to be injured by the door or trapped between the door while closing. The door system shall meet the test requirements defined in Test methods para 6.5.

3.4.4.9.3 The movement of the doors shall not be abrupt.

3.4.4.10 **Additional Requirements for Automatic doors**

3.4.4.10.1 **Activation of opening circuits**

3.4.4.10.1.1 The opening controls of every automatically operated service door shall be capable of being activated and deactivated only by the driver from his

seat. However provision in para 3.4.4.9.1 shall apply in the event of an emergency.

3.4.4.10.1.2 Activation of opening controls by the driver shall indicate the status by means of indicators (illuminated push button/sign) placed on or adjacent to the door whose control has been activated.

3.4.4.10.2 **Opening of automatically operated Service Doors**

3.4.4.10.2.1 After activation of the opening controls by the driver, the passenger shall be able to open the door by one of the methods below :

- from inside by a push button control or a passing through a light barrier.
- from outside by a illuminated push button clearly indicating status.

3.4.4.10.3 **Closing of automatically operated Service Door**

3.4.4.10.3.1 The automatically operated service door shall close automatically after a time interval of opening of the door. If a passenger enters or exits during this time interval, a safety device (e.g. a foot board contact, light barrier) shall ensure that the time until the door closes is sufficiently extended.

3.4.4.10.3.2 If a passenger enters or exits while the door is closing, the closing process shall be interrupted and the door shall return to the open position.

3.4.5 **Emergency Exits**

3.4.5.1 **Emergency Doors**

3.4.5.1.1 The emergency doors shall be capable of operation from both inside and outside when operated manually. However this requirement shall not be construed as precluding possibility of locking the door from outside provided the door can be opened from inside.

3.4.5.1.2 The outside handles of emergency doors shall lie within 200 mm on either side of centreline of the door drawn in the horizontal plane. However, the position of the outside handle shall not be more than 1800 mm above the ground level in the unladen condition.

3.4.5.1.3 Doors shall be hinged at the forward edge and in case of horizontal door the hinge shall be on the top edge.

3.4.5.1.4 Emergency doors shall not be power operated or of sliding type.

3.4.5.1.5 Emergency doors shall open outward and shall be capable of remaining open outwards and at an angle of atleast 100^{o}, such that aperture is clear of any obstructions.

3.4.5.1.6 Door check, stay or strap which is capable of meeting requirements specified in para 3.4.5.1.5 may be used.

3.4.5.1.7 The forward edge of the emergency door shall be behind or in the same transverse plane tangent to the rear-most point of a seat back adjacent to it.

3.4.5.1.8 All emergency doors shall be provided with an audible device to warn the driver when the emergency doors are not securely closed. The warning device shall operate due to the movement of the door catch and not by the movement of the door itself.

3.4.5.1.9 Reserved

3.4.5.2 **Emergency Windows**

3.4.5.2.1 Emergency windows equipped with ejection type of construction shall be meet the requirement specified in IS 13944: 1994.

3.4.5.2.2 Every hinged or executable emergency window shall open outwards.

3.4.5.2.3 Every emergency window shall:

3.4.5.2.3.1 either be capable of being easily and instantaneously operated from inside and from outside the vehicle by means of a device, or

3.4.5.2.3.2 be made of readily breakable safety glass. In such case a device shall be provided adjacent to each emergency window, available to the person in the vehicle for ready access for breaking the window. The window glass shall be made of safety glass as specified by IS 2553 (Part 2):2019 and shall readily break on impact when hit by a hammer in the event of an emergency.

3.4.5.2.4 Every emergency window which can be locked from outside shall be constructed such that it shall be capable of being opened at all times from inside.

3.4.5.2.5 Emergency window where horizontally hinged at the top edge shall be provided with a suitable stay to hold the door fully open. Every emergency window shall operate such that it does not obstruct clear passage.

3.4.5.2.6 Every hinged emergency window which is not visible from the driver's seat shall be fitted with a audible warning device to warn failure of locking system.

3.4.5.3 **Escape Hatches**

3.4.5.3.1 Escape hatches shall be ejectable, hinged or readily breakable safety glass. Operation of escape hatch shall not obstruct clear passage from inside or outside the vehicle. Ejectable type hatches shall not detach from the vehicle fully.

3.4.5.3.2 Escape hatches shall be capable of being easily operated from inside and from outside the vehicle. However this requirement shall not be construed as precluding the possibility of locking the escape hatch for the purpose of securing the vehicle when unattended, provided that the escape hatch can always be opened from inside the vehicle.

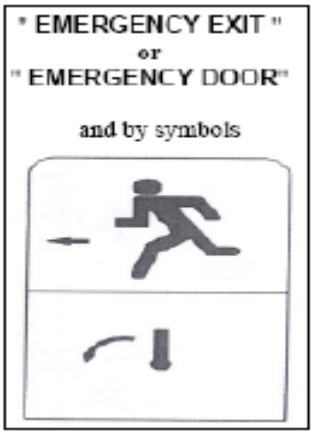
3.4.5.3.3 In case breakable safety glass is provided, a device shall be provided for breaking the escape hatch.

3.4.5.4 **Marking of Emergency Exits**

3.4.5.4.1 All emergency exits shall be prominently designated in red letters in English when viewed from inside.These instructions shall be located within 150 mm of the release mechanism.

" EMERGENCY EXIT "
or
" EMERGENCY DOOR"

and by symbols



when viewed from inside. Concise operating instructions describing each motion necessary to unlatch and open the exit shall be displayed. These instructions shall be located within 150 mm of the release mechanism.

3.4.5.5 Safety Signs - General Requirements.

3.4.5.5.1 Each safety sign required by this Standard shall be used to communicate only one safety message. The information provided shall be in the form of pictograms, however, words, letters and numbers may supplement the pictogram in combination on the same sign. It shall be located and orientated so as to be easily understood.

3.4.5.5.2 Pictograms indicating a required action by the user shall show a person, or the relevant part of a person, operating the equipment or control device.

3.4.5.5.3 Pictograms indicating a required movement shall, where appropriate, show an arrow pointing in the direction of motion. Where a rotational movement is required, a curved arrow shall be used. Safety signs shall follow the principles shown in the example layouts below;

3.4.5.5.4 Where devices are to be operated, panels removed or doors opened, the pictogram shall indicate the action in progress.

3.4.5.5.5 The lower case letter(s) of supplementary words, single letters and numbers shall have a minimum height of 10 mm.

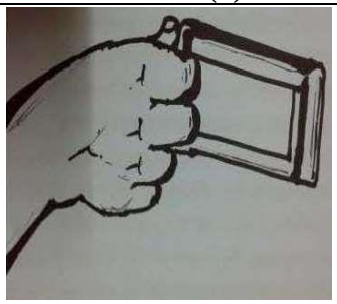
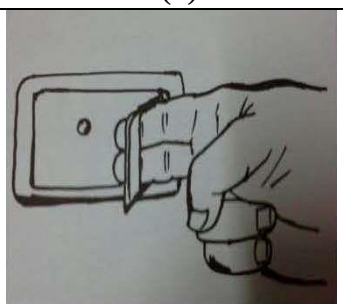
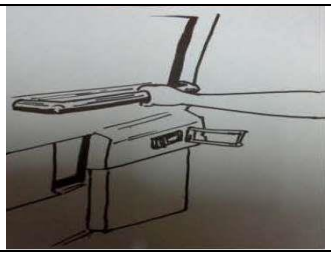
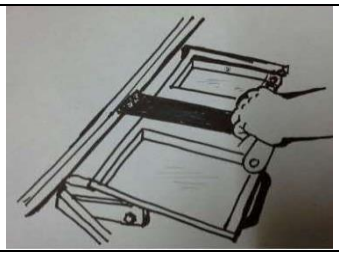
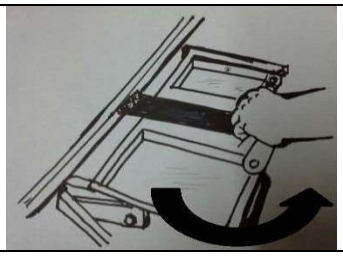
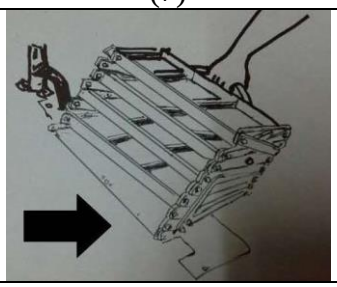
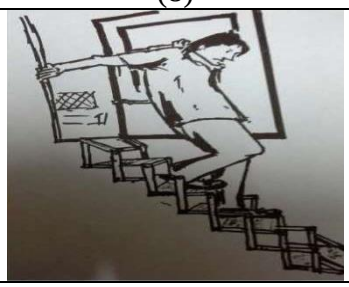
3.4.5.5.6 All safety signs shall be of photo-luminescent material.

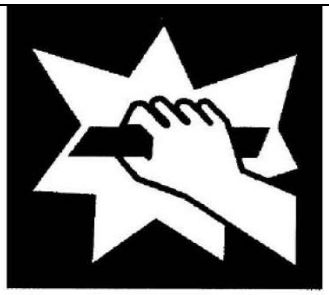
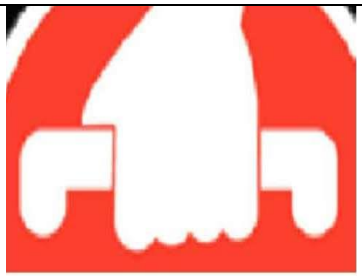
3.4.5.5.7 All safety signs shall comprise a Red pictogram on a White colour background.

3.4.5.5.8 Safety signs identifying the control or the device for breaking/opening

emergency windows/doors shall be positioned adjacent to, or surround all internal and external emergency controls for all exits.

3.4.5.5.9 Safety signs shall not be located in positions where they may be obscured during operation of the vehicle. However, a curtain or blind may be positioned over an emergency window provided an additional safety sign indicates that the emergency window is located behind the curtain or blind.

ALERT NOTICE (INSIDE THE DOOR)		
	(2)	(3)
		
Emergency Exit Door	Lift the cover to access lock.	Lift the handle to unlock
(4)	(5)	(6)
		
Push the door to open	Release the strap of emergency foot strap	Rotate the step to engage
(7)	(8)	
		
Push the step out	Start Evacuation	
ALERT NOTICE (OUTSIDE THE DOOR)		
(9)	(10)	(11)

		
Break the glass	Lift the handle	Stay away from the door

3.4.5.6 **Technical requirements for Retractable/Collapsible steps ~~(if fitted)~~ :**

Retractable/Collapsible steps if fitted shall comply with the following requirements:

3.4.5.6.1 The operation of Retractable/ Collapsible steps may be synchronized with that of the corresponding service or emergency door;

3.4.5.6.2 When the door is closed no part of the Retractable step shall project more than 10 mm beyond the adjacent line of the body work. Similarly, the collapsible step in non-usage position shall not intrude into passenger seat space or obstruct the emergency door access by more than 10mm.

3.4.5.6.3 When the door is open and the Retractable/Collapsible steps is in the extended position, the steps shall conform to the requirements of paragraph 2.2.5 of this standard;

3.4.5.6.4 In the case of a manually operated step, when the step is in the extended position, an audible indication shall alert the driver when the step is not fully retracted or the emergency door is open.

3.4.5.6.5 If the device to operate the step fails, the step shall remain in the retracted position/original position. However, the operation of the corresponding door shall not be hindered in the event of such a failure or by the step being damaged or obstructed.

3.4.5.6.6 The corners of Retractable/Collapsible steps facing forwards or rearwards shall be rounded to a radius of not less than 5 mm; the edges shall be rounded to a radius of not less than 2.5 mm;

3.4.5.6.7 When the passenger/emergency door is open, the Retractable/Collapsible step shall be securely held in the extended position. When a mass of 136 kg is placed in the centre of a single step or a mass of 272 kg is placed in the centre of a double step the deflection at any point on the step, measured relative to the body of vehicle, shall not exceed 50 - 60 mm.

3.5 Door Components

3.5.1 Door components shall meet the requirements specified in Rule 124 of CMVR. The door components shall be meet requirements specified in para 6.6.

Table 1 Standards Related to Door Components	
Description	**Standard No**
Automotive Vehicles:- locking systems and door retention components – general requirement	IS 14225-1995*
Automotive Vehicles:-window retention and release systems for buses	13944-1994*
* As amended from time to time	

3.6 Window

3.6.1 Where windows with glazing are provided the glazing shall meet requirement specified as in para 3.6.2 & 3.6.3.

3.6.2 **Window Glazing**

3.6.2.1 The window glass shall be made of safety glass as specified in IS 2553 Part 2 and shall readily break on impact when hit by a hammer in the event of an accident.

3.6.3 **Thickness of glazing**

3.6.3.1 Minimum glazing thickness for windows, shall be as per IS:2553 (Part-2) as amended from time to time.

3.6.4 **Edges**

3.6.4.1 The edge shall be crown edge, satin finish for all the exposed edges that is likely to come in touch with the passenger's body. (This Edge specification corresponds to Edge No. 1 specified in SAE J673).

3.6.5 **Window Frames**

3.6.5.1 The glazing may be mounted on frame; constructed from aluminum extrusions or formed steel/coated sections. Alternately directly, sliding on flocked rubber channels supported by aluminum/steel section.

3.6.5.2 The window frames shall be mounted such that distortions and change of aperture dimensions due to forces on the structure does not deform the guideways. The window glass/glass and frame shall slide smoothly when subjected to normal pull force (50 to 75N)

3.6.5.3 The window frame shall be attached to the structure by weather strips or bonded with adhesive or any other suitable method.

3.6.5.4 The mounting shall meet requirement specified in BIS Standard- Window retention and release system for Buses Safety Requirement IS 13944-1994. However, this requirement shall not be applicable for Mini buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons.

3.6.5.5 The window frame fitted on buses shall meet the requirements specified in AIS-068 as amended from time to time however AIS-068 shall not be applicable for pasted or fixed glass windows

Table 2
Related standards for Window Glazing

Description	Standard No
Safety Glasses: Part 2 for Road transport	IS 2553 Part 2*
Window retention and release system for Buses:- Safety Requirement	IS: 13944-1994*
Water Proofing Test on Automobiles	IS 11865-1992*
* As amended from time to time	

3.7 Ingress of dust and rain water :

3.7.1 All body joints, front safety glass, rear safety glass, doors, windows and hatches should be so constructed such that it does not permit ingress of rain water, in the fully closed condition. It is recommended that the bus body builders carry out their own internal assessment test to check water proofing as per IS : 11865 – 1992.

3.7.2 All body joints, front safety glass, rear safety glass, doors, windows and hatches should be so constructed such that it does not permit ingress of dust, in the fully closed condition. It is recommended that the bus body builders carry out their own internal assessment test to check dust ingress as per IS : 11739 – 1986 as amended from time to time.

3.7.3 Drain holes shall be provided in the window frame such that water shall flow outward and does not flow into the structure cavity or into the passenger compartment.

3.8 Body Insulation

3.8.1 Body insulation shall be provided with suitable material for DLX and ACX buses and optional for other categories. It is recommended to use materials like Polyurethane or Glass Wool of minimum thickness of 40 mm and minimum density of 40 kg/m^3. Materials superior to the ones shall also be permitted.

3.9 Rear View Mirrors

3.9.1 The rear view mirrors shall meet the requirements specified in AIS Standards AIS-001 (Part 1)(Rev. 2):2023 & Corrigendum1 and AIS-002 (Part 1) (Rev.2):2023 as amended from time to time.

3.10 Wind Screen Wiping System and Driver's field of Visions

3.10.1 The Wind Screen Wiping System shall meet the requirements specified in IS-15802:2008 as amended from time to time.

3.11 Vehicle Seats and Seat Belts

3.11.1 All Seat designs and Seat anchorage designs used in buses, shall meet the requirements of AIS-023 as amended from time to time.

3.11.2 All types of buses shall be provided with seat belts as per the provisions of CMVR. The seat belts assemblies and their anchorages shall meet the requirements of IS 15140:2018 and IS 15139: 2002 as amended from time to time.

3.11.3 The Seats used in buses shall be those which are type approved by the testing agency as per AIS-023, as amended from time to time.

3.12 Reserve

3.13 Pad Material

The recommended pad material for various types / categories of buses are as given in table below. Materials superior to the ones indicated in this table shall also be permitted.

		Fibre glass / Polymer (moulded)	PU Foam	Rubberised coir	Latex foam	Moulded P.U. Foam
	NDX	✓	✓	✓		
	SDX		✓			
	DLX				✓	✓
	ACX				✓	✓

3.14 Upholstery

The recommended upholstery for various types / categories of buses are given in table below. Materials superior to the ones indicated in this table shall also be permitted.

	PVC Rexene	Foam Rexene	Tapestry Cloth	Velvet Cloth
NDX	✓			
SDX		✓		
DLX			✓	✓
ACX			✓	✓

3.15 Other Features

The recommended features for various types / categories of buses are given in table below. However, features superior to the ones indicated in this table may also be permitted.

Feature	NDX	SDX	DLX	ACX
Head Rest			✓	✓
Seat Arm			✓	✓
Seat Back-Fixed	✓	✓		
Seat Back - Reclining			✓	✓
Magazine Pouch			✓	✓
Fan on each row (min. of 12 Watts)			✓	
Reading Lights				✓

Table 3 Recommended Specifications for moulded polyurethane cushion :			
Sl. No.	**Characteristic**	**Specification**	**Test Method**
1.0	Density	40 - 60 kg/m^3	As per IS 7888 – 1976
2.0	Compression set	12 % Max.	As per IS 7888 – 1976
3.0	Tensile test	1.2 to 1.9 kg/cm^2	As per IS 7888 – 1976
4.0	Elongation	110% Min.	As per IS 7888 – 1976
5.0	Resilience	58 - 63 %	As per JIS K 6401
6.0	Rebound fatigue	1,00,000 cycles	As per ISO 3385-1989
	Reduction in height	8% Max.	
	Reduction in hardness	12% Max.	
7.0	Flammability requirements for the foam & upholstery		As per IS 15061:2002

Table 4 Related Standards for Cushion / Pad Materials	
Description	**Standard No**
Molded Rubberize Coir Cushion	IS 11060 :1984
Latex Foam Rubber Products	IS 1741:1960

Table 5 Related Standards for Upholstery	
Description	**Standard No**
Vinyl Coated Fabric	IS 1259:1984
Expanded Vinyl Coated Fabric	IS 8698
PVC Coated Fabric	IS 3322 Part I : 1987
Rayon Velvet	IS 4439:1988
Textile Covering – Tufted Carpet	IS 5884:1995
Jacquard	

3.16 Reserved

3.17 Corrosion Protection

3.17.1 The quality of the surface treatment shall be tested according to the test methods specified in JIS D0202 or any equivalent standards including BIS

<table>
<tr><td colspan="4">Standard. (General Rules of Coating Films for Automotive Parts or equivalent Indian Standards using test panels.) The minimum quality requirements in table below shall be met for test criteria specified in para. 4 of JIS D0202. The compliance to this requirement shall be demonstrated by the body builder to the testing agencies.</td></tr>
<tr><th>Painted or coated panels</th><th colspan="3">Quality</th></tr>
<tr><td>Surface Condition – Appearance</td><td colspan="3">There must be no surface roughness, pin holes or other harmful defects.</td></tr>
<tr><td>Corrosion Resistance or Water / moisture resistance</td><td colspan="3">96 (Hrs)</td></tr>
<tr><td>Oil Resistance (40 Deg. 24 hrs)h</td><td colspan="3">No swelling, flaking, peeling, cracking, film softening nor appreciable change in lustre or colour</td></tr>
<tr><td>Volatile Oil Resistance (Gasoline) (24 hrs)</td><td colspan="3">No swelling, flaking, peeling, cracking, film softening nor appreciable change in lustre or colour</td></tr>
<tr><td>Pencil Scratch Test</td><td colspan="3">Shall resist HB or Harder</td></tr>
<tr><td rowspan="2">Checker Mark : No of sections in which film remains intact (without peeling off)
Grade 3 shall apply only to Copper and copper alloy bases, Aluminum and aluminum alloy bases and Zinc and Zinc alloy bases</td><td>Grade 1</td><td>Grade 2</td><td>Grade 3</td></tr>
<tr><td>100</td><td>90 or more</td><td>60 or more</td></tr>
</table>

Note: Bus Body Manufacturer should provide relevent internal reports or a declaration for compliance for relevant structural and body parts to respective standard.

3.18 Protection against fire risk

3.18.1 **Engine Compartment**

3.18.1.1 All Type 1 buses shall be fitted with the FDSS meeting the requirements of AIS-135:2016, as amended from time to time.

3.18.2 **Fuel filler apertures**

3.18.2.1 Fuel filler apertures shall be accessible only from exterior of the vehicle.

3.18.3 **Fuel Tank**

3.18.3.1 Position of filler aperture shall be as fitted by the vehicle manufacturer. Alteration/ relocation of the fuel tank shall not be permitted unless approval

obtained from the vehicle manufacturer and test agency.

3.18.3.2 No part of the fuel tank shall project beyond the overall width of the body work.

3.18.4 **Fuel feed System**

3.18.4.1 Alterations shall not be permitted on fuel feed system provided by the vehicle manufacturer. The Coach builder shall obtain Type approval for carrying out any modification prior to any alteration if deemed necessary.

3.18.4.2 No apparatus used for the fuel feed shall be placed in the driver's compartment or the passenger compartment.

3.18.4.3 Fuel lines and all other parts of the fuel feed shall be accommodated in the vehicle where they have the optimum protection.

3.18.4.4 It is recommended that twisting and bending movements and vibrations of the vehicle or the power unit do not subject the fuel lines to abnormal stress. It is also recommended that the union of pliable pipes with rigid parts of fuel feed system must be so designed and constructed as to remain leak proof in various condition of use of the vehicle despite ageing, twisting or bending movements, or vibration of the vehicle structure or power unit. Fuel leaking from any part of the engine system be able to flow away freely to the road surface, but never into the exhaust system.

3.18.5 **Fire extinguishers**

3.18.5.1 The vehicle shall be equipped with one or more Fire extinguishers, one being near to the driver's seat.

3.18.5.2 Type and the minimum number of extinguishers to be provided shall be as follows:

	Standard bus	Midi & Mini bus	
Total Capacity of extinguisher	**Type I**	**Midi Bus**	**Mini Bus**
10 kg rating for Standard Bus (Other than Midi and Mini Buses) & 4 kg rating for Midi and Mini Buses) 21A 113B CEN Std EN 3 Pt.1	-Minimum two nos. of fire extinguishers shall be provided. -Minimum Capacity shall be 2kg. -Total capacity shall be 10kg.	-Minimum two nos. of fire extinguishers shall be provided. -Minimum capacity shall be 1kg. -Total capacity shall be 4kg.	-Minimum two nos. of fire extinguishers shall be provided. -Minimum capacity shall be 1kg. -Total capacity shall be 4kg.

Note : Fire extinguishers shall comply with IS : 13849 or IS : 2171as am from time to time, as may be applicable

3.18.5.3 Halogenated hydrocarbon type of extinguisher shall not be used as extinguishant.

3.18.5.4 Fire extinguisher shall be secured against tampering and shall be kept at an easily accessible location.

3.19 First aid Equipment

3.19.1 First Aid Kits containing items notified under Rule 138 (4) (d) of CMVR 1989 shall be provided.

3.19.2 Space shall be provided for fitting more than one first-aid kit.

3.19.3 The First aid kits shall be secured against tampering and shall be kept in lockers or behind breakable glass. The location shall be marked clearly.

3.20 Modification of Chassis and / or Chassis related Components

3.20.1 Alterations shall not be permitted on the chassis or any of its aggregates or components. Any modifications shall call for fresh type approval of the design and the prototype.

3.21 A.C. System

3.21.1 The A.C. system shall meet the technical and safety requirements as and when notified.

3.22 Interior Noise

3.22.1 Interior noise level of buses with front engine shall not exceed 85 dB (A) and that for buses with rear engine shall not exceed 80 dB (A), when tested as per IS: 12832-2010 (Reaffirmed 2016), as amended from time to time.

3.23 **Vibration:**

3.23.1 **Lowest natural frequency**

3.23.1.1 **Requirements**

Bus structure shall have adequate stiffness to ensure that the lowest natural frequency of the vehicle sprung mass (i.e chassis and body) shall be greater than equal to 5 Hz for modes like vertical force, bending and greater than equal to 3 Hz in case of torsional mode under following static loading condition:

Normal Loads = Number of Passenger x [weight of the passenger (68 kg) + Passenger luggage weight (7kg)]

Explanation: 1st global mode representing lowest natural frequency of the vehicle structure which includes chassis and superstructure together shall be greater than equal to 5Hz for vertical force and bending modes and greater than equal to 3 Hz in case of torsional mode. Panel and other local part modes shall be ignored while predicting lowest natural frequency of the vehicle.

<table>
<tr><td>3.2.23.2</td><td>Evaluation procedure is given in Appendix 1.</td></tr>
<tr><td>3.24</td><td>Acceleration Levels</td></tr>
<tr><td>3.24.1</td><td>Requirements</td></tr>
<tr><td>3.24.1.1</td><td>When tested as specified in 5.4.1 of Appendix II, the maximum (rms) vibrations level acceleration av value as per Clause No. 6.5 of ISO 2631 Part 1:1997 shall not exceed the following limits*.
<table>
<tr><th></th><th>Front and rear mechanical suspension</th><th>Front air and rear mechanical suspension</th><th>Front and rear air suspension</th></tr>
<tr><td>At driver and passenger seats</td><td>3 m/s^2</td><td>2 m/s^2</td><td>1.5 m/s^2</td></tr>
<tr><td>At gangway</td><td>6 m/s^2</td><td>4 m/s^2</td><td>2 m/s^2</td></tr>
</table></td></tr>
<tr><td>3.24.2</td><td>Testing procedure is given in Appendix II.</td></tr>
<tr><td>3.24.3</td><td>Criteria for extension of approval in case of vibration test</td></tr>
</table>

3.24.3.1	IF the vibration values of a variant having an all mechanical suspension complies with values applicable for mechanical and air suspension limits, then the values observed on the variant with all mechanical suspension can be extended to the variant with mechanical and air suspension.
3.24.3.2	If the vibration value of a variant having an all mechanical suspension complies with values applicable for all air suspension limits, then the values observed on the variant with all mechanical suspension can be extended to the variant with all air suspension.
3.24.3.3	If the vibration value of a variant having a mechanical and air suspension complies with values applicable for all air suspension limits, then the values observed on the variant with all mechanical and air suspension can be extended to the variant with all air suspension,
3.24.3.2	Manufacturers shall demonstrate to test agency that test vehicles are identical in all aspects except suspension.
3.25	**Harshness (Transient Vibration) :**
3.25.1	Requirements
3.25.1.1	When tested as specified in 5.4 of Appendix III, the maximum transient (running rms) vibrations level av value as per Clause No. 6.5 of ISO 2631 Part 1: 1997shall not exceed 0.3g [3 m/s^2] at driver seat and 1g[10 m/s^2] at passenger seats.
3.25.1.2	When tested as specified in 5.4 of Appendix III, the dominant frequencies falling in the range of 0.5 -1 Hz, 5-7 Hz and 18-20 Hz shall not exceed 3 m/s2 for driver seat & 10 m/s2 for passenger seats.
3.25.1.3	Testing procedure is given in Appendix III.
3.25.1.4	Criteria for extension of approval in case of harshness test
3.25.1.4.1	IF the harshness values of a variant having an all mechanical suspension complies with values applicable for mechanical and air suspension limits, then the values observed on the variant with all mechanical suspension can be extended to the variant with mechanical and air suspension.
3.25.1.4.2	If the harshness value of a variant having an all mechanical suspension complies with values applicable for all air suspension limits, then the values observed on the variant with all mechanical suspension can be extended to the variant with all air suspension.
3.25.1.4.3	If harshness value of a variant having a mechanical and air suspension complies with values applicable for all air suspension limits, then the values observed on the variant with all mechanical and air suspension can be extended to the variant with all air suspension.
3.25.1.4.4	Manufacturer shall demonstrate to the test agency that test vehicles are identical in all aspects except suspension.

3.26	**Braking Performance & Vehicle Stability Function**
	All buses shall comply for improved braking performance in accordance with AIS-150:2018 or IS 11852:2019, as amended from time to time.

CHAPTER : 4

LIGHTING & ILLUMINATION

4.1 Lighting, Signalling and Indicating Systems-

4.1.1 **External**

4.1.1.1 External lighting and light-signaling devices of the bus shall comply with the Rules laid down under the Central Motor Vehicle Rules, 1989, and as amended from time to time.

4.1.1.2 All lighting and light-signaling devices shall be Type Approved"

4.1.2 **Internal**

4.1.2.1 Lighting and light-signaling devices shall provide adequate illumination inside the bus for the safe operation by the driver and the passengers, during darkness and other conditions of reduced visibility.

4.1.2.2 **Position of illumination devices**

4.1.2.2.1 The following lamps are to be placed on the roof of the bus, above the head of the observer -

- Cab lamp or courtesy lamp
- Passenger area lamps

4.1.2.2.2 The following lamps are to be placed at door apertures -

- Exit lamps

4.1.2.2.3 The following lamps are to be placed inside the compartment/ unit/control

- Locker lamp
- Electrical distribution centre lamp - Instrument lighting
- Control unit lamps

4.1.2.3 **Type of Bulbs for lamp Assemblies**

4.1.2.3.1 The following lamp assemblies can be illuminated either by incandescent bulbs or L.E.D (Light Emitting Diodes) or any other suitable light source –

- Tell-Tale lights
- Instrument lights
- Control unit lamps"

4.1.2.3.2 The following lamp assemblies can be illuminated by incandescent bulbs or any other suitable light source

- Electrical distribution centre lamp

- Locker lamp

4.1.2.3.3 The following lamp assemblies can be illuminated by incandescent bulbs or fluorescent bulbs or L.E.D. (Light Emitting Diodes) or any other suitable light source –

- Entrance lamps
- Cab lamp or courtesy lamp
- Passenger area lamp

4.1.2.4 **Photometric requirements**

4.1.2.4.1 Lighting requirements of the Lighting and light-signaling devices for the following sub groups:-

- Dash Board Tell tale lighting/Control lighting
- Driver Cabin lighting
- Passenger Compartment lighting
- Other Area lightings

4.1.2.4.1.1 **Dash Board Tell tale lighting/Control lighting**

4.1.2.4.1.1.1 Lamps falling in this category –

- Instrument lighting
- Tell-tale lighting
- Control unit lamps

4.1.2.4.1.1.2 The lighting devices used for dash board shall be discreet and shall not disturb the driver when driving in the dark.

4.1.2.4.1.1.3 The strength of the instrument lighting can be capable of regulation through a rheostat or any other suitable means, optionally.

4.1.2.4.1.2 **Driver Cabin lighting**

4.1.2.4.1.2.1 The following lamps fall in this category :

- Cab lamp or courtesy lamp
- Locker lamp
- Electrical distribution lamp

4.1.2.4.1.2.2 The lighting devices used for cabin interior should be sufficient enough for clearly distinguishing each component part of the cabin. The driver should be in a position to read signages written on the walls, door of the cabin. He should also be in position to read any instructions printed on

paper.

4.1.2.4.1.2.3 The luminous flux of all the lamps provided for cabin lighting to light up the equipment, components and to read, shall not be less than 30 lux and shall not be more than 150 lux, when measured at 500 mm above the driver seat base.

4.1.2.4.1.2.3.1 The driver's compartment shall be provided with illumination through separate circuit.

4.1.2.4.1.3 **Passenger Compartment lighting**

4.1.2.4.1.3.1 The following lamps fall in this category:-

- Exit lamps
- Passenger area lamps

4.1.2.4.1.3.2 The lighting devices used for passenger area should ensure reading of signages inside the passenger area and other important signs like emergency signs. The illumination should light up handles, latches, knobs, rods, hand-holds, etc facilitating easy access to passenger. The illumination should be adequate for reading printed matter by the passenger.

4.1.2.4.1.3.3 The illumination of these lamps shall not be less than 50 lux, when measured at any seating location of the bus and at 500 mm above the seat base.

4.1.2.4.1.3.4 At least two night lights shall be provided in the passenger compartment of all buses except Type I buses. The interior lighting shall be designed such that the glare and reflections caused does not affect the driver."

4.1.2.4.1.4 **Other Area Lightings**

4.1.2.4.1.4.1 Destination panel lighting: The front, rear and side (optional) of the vehicle shall be illuminated or self illuminated (e.g. LED based destination boards) in such a way that the inscription on the panel/board shall be visible at a distance of 30 metres.

4.1.2.4.1.4.2 Side marker lamp: These are to be mounted on the side of the vehicle and shall be of amber colour. They shall be mounted on a height of 250 – 1500 mm above the ground.

4.2 Type Approval

4.2.1 The lighting and light-signaling devices fitted in buses shall be type approved for performance as well as installation requirements as notified under Central Motor Vehicles Rules, 1989 and as amended from time to time.

4.2.2 All the above information shall be incorporated in the technical specification submitted for the type approval.

CHAPTER : 5
ELECTRICAL EQUIPMENT AND WIRING

5.1 Electrical cables

5.1.1 All cables used shall be compliant with BIS / DIN / ISO / SAE / JIS or JASO or other equivalent standard and shall be able to withstand working temperature upto 70°C.

5.1.2 All the cables shall be ducted and secured at suitable places in such a manner that during normal use of vehicle the cables are not subjected to any tension, stretching, nicking, cutting, abrasion or chaffing.

5.1.3 The conductor cross section shall be selected to carry the rated current as given below or according to one of the standards mentioned in para 5.1.1:-

Specification for Low Tension Wire for Automotive Application

Allowable Current (A)	**Number/ Diameter of wire in (mm)**	**Cross Sectional Area in (mm^2)**	**Outer Diameter (mm)**	**Finished Outer Diameter (mm)**
9	7/0.32	0.5629	1.0	2.2
12	11/0.32	0.8946	1.2	2.4
15	16/0.32	1.267	1.5	2.7
20	26/0.32	2.081	1.9	3.1
28	41/0.32	3.287	2.4	3.8

Table 1. Electrical copper conductors for motor vehicles
Single-core, untinned, PVC-insulated. Permissible working temperature: 70°C.[2)]

Nominal conductor cross-sectional area mm^2	Approx. number of individual strands[1)]	Maximum impedance per meter[1)] at + 20°C m Ω/m	Maximum conductor diameter [1)] mm	Nominal thickness of insula-tion[1)] mm	Maximum external diameter of insulated wire[1)] mm	Permissible continuous current (guide figure)[2)] at ambient temperature of + 30°C A	+ 50°C A
1	32	18.5	1.5	0.6	2.7	19	13.5
1.5	30	12.7	1.8	0.6	3.0	24	17.0
2.5	50	7.60	2.2	0.7	3.6	32	22.7
4	56	4.71	2.8	0.8	4.4	42	29.8
6	84	3.14	3.4	0.8	5.0	54	38.3
10	80	1.82	4.5	1.0	6.5	73	51.8
16	126	1.16	6.3	1.0	8.3	98	69.6
25	196	0.743	7.8	1.3	10.4	129	91.6
35	276	0.527	9.0	1.3	11.6	158	112
50	396	0.368	10.5	1.5	13.5	198	140
70	360	0.259	12.5	1.5	15.5	245	174

95	475	0.196	14.8	1.6	18.0	292	207
120	608	0.153	16.5	1.6	19.7	344	244

1) To DIN ISO 6722, Part 3.
2) To DIN VDE 0298, Part 4.

5.2 Fuse

5.2.1 Every electrical circuit shall be provided with fuse designed for the circuit. In case of multiple circuits a common fuse shall be permitted, subjected to suitable current capacity per circuit depending upon the individual electric load.

The current carrying capacity of the fuse shall be :
Rated Current of Fuse = 1.5 times the Load Current of the Electrical Equipment

5.3 Terminals, Connectors & Elements

5.3.1 End terminations: All the ends shall be suitably crimped with lugs /soldered or fixed so as to withstand vehicle vibrations.

5.3.2 The interconnection shall be through couplers/junction boxes/ terminal blocks.

5.3.3 Suitable connectors shall be used for external areas which are exposed to atmosphere to avoid water /moisture ingress during use.

5.4 Safety requirements

5.4.1 Use of relays and other electrical elements shall be adopted where the current rating of the switches is not adequate.

5.4.2 The additional circuits shall not draw current more than specified by the manufacturer.

5.4.3 Where the voltage exceeds 100 Volts RMS (Root Mean Square) in one or more electrical circuit, a manually operated isolation switch which is capable of disconnecting the circuit(s) from the main electrical supply shall be provided and shall be located inside the vehicle. Alternatively, electrically operated battery cut off switch may be provided."

5.4.4 No circuit provided by the vehicle manufacturer or type approved shall be modified.

5.4.5 The isolation circuit shall have provision for bypassing circuits supplying mandatory external vehicle lighting i.e. besides the main isolation switch, individual isolation switches shall be used in series with main isolation switch, each for internal lighting and external mandatory lighting.

5.4.6 Electrical cables shall be located such that no part can make contact with

any fuel line or exhaust system subjected to excess heat. Suitable special insulation shall be provided where such electrical circuits are necessary.

5.4.7 Electrical conductors shall meet the requirement for flame resistance specified in para 6.7

5.5 Batteries

5.5.1 All batteries shall be well secured and easily accessible.

5.5.2 The battery compartment shall be separated from the passenger compartment and if provided in driver's compartment, it shall be covered and well ventilated.

5.5.3 Battery terminals shall be protected against short circuit risk.

5.5.4 Isolation Switch: A manually or electrically operated isolation switch, which is capable of disconnecting the battery terminal from the electrical circuit, shall be provided.

5.6 **Electrical Wiring and Circuits**

5.6.1 **Multiplexing/electronic architecture**

All buses with 24 V System, shall meet requirements of multiplexing nodes architecture as specified in Appendix IV to this standard.

5.6.2 The circuit diagram for the bus provided by OE vehicle manufacturer shall not be tampered"

Table
Standards Related to Electric Equipment & Wiring

Description	Standard No.
Cables for Motor Vehicles	IS 2465 : 1984*
Cable Termination for Automobile Wiring Blade Type Connectors	IS 8395 : 1977 Part I*
Cable Termination for Automobile Wiring Bullet & Tube Type Connectors	IS 8395 : 1977 Part II*
Low Voltage Fuses	IS 13703 : 1993 Part I*
Colour Code of Electrical Wiring for major electrical circuits	IS 13313 : 1991 *
Cartridge Fuse links for Automobiles	IS 2577 : 1974*/JASO D601

Porcelain (Molded) Fuse links for Automobiles	IS 7528 : 1974*
Fuses for Automobiles	IS 4063 : 1982*
Piano key type switches for use in automobiles	IS 9433 : 1980*
Automobile Lamps	IS 1606 : 1979*
Electrical Circuits	IS 14381 : 1996*
*as amended from time to time.	

CHAPTER : 6

TEST METHODS

6.0 Reserved

6.1 Reserved

6.1.1 Reserved
6.1.1.1 Reserved
6.1.1.2 Reserved
6.1.1.3 Reserved
6.1.1.4 Reserved
6.1.1.5 Reserved
6.1.2 Reserved
6.1.2.1 Reserved
6.1.3 Reserved
6.1.3.1 Reserved
6.1.4 Reserved
6.1.4.1 Reserved
6.1.4.1.1 Reserved
6.1.4.1.2 Reserved
6.1.4.1.3 Reserved
6.1.4.1.4 Reserved
6.1.4.1.5 Reserved
6.1.4.1.6 Reserved
6.1.4.2 Reserved
6.1.4.2.1 Reserved
6.1.4.2.2 Reserved
6.1.4.2.3 Reserved
6.1.4.2.4 Reserved
6.1.4.2.5 Reserved
6.1.4.2.6 Reserved
6.1.4.2.7 Reserved

6.1.5 Reserved

6.1.5.1 Reserved

6.2 Stability Test

6.2.1 **Test Requirements**

6.2.1.1 When the surface on which the vehicle stands were tilted to both sides in turn at an angle of 28 degrees from the horizontal the vehicle shall not overturn.

6.2.2 **Test Condition**

6.2.2.1.1 For the purpose of test the vehicle, the unladen vehicle with addition of : Load equal to 75 kg (68 kgs standard mass of passenger + 7kgs luggage) shall be placed on each passenger and crew seat. Where vehicle is designed to carry standee passengers a load of 75 Kg. is placed with its centre of gravity at a height of 875 mm from the floor. The load shall be uniformly distributed.

6.2.2.1.2 Reserved

6.2.2.1.3 Alternatively a calculation method may be used to prove that the vehicle will not overturn under conditions specified in para 6.2.2.1.1. The Calculation method shall be approved by the test agency. The coach builder shall establish the validity of the calculation method to the satisfaction of the Test Agency on the basis of comparative test with a similar vehicle.

6.2.2.2 **Test Method**

6.2.2.2.1 The vehicle shall be subjected to test on a tilt test rig. Height of step used to prevent the vehicle from slipping side ways on the test rig shall not be greater than two third of the distance between the surface on which the vehicle stands and part of the rim of the wheel which is nearest to the surface in the untilted position. Ref. Fig. 8.

6.2.2.3 **Acceptance Criteria**

6.2.2.3.1 The stability of a vehicle shall be considered to comply with the requirement if the angle at which overturning occurs is greater than 28 degrees from the horizontal.

6.3 Impact Strength for Bumpers

6.3.1 The front and rear bumpers of the vehicle shall meet the requirements prescribed in relevant standard as and when notified.

6.4 Seat Requirements

6.4.1 **Performance and Strength Requirements for Driver / Co-driver Seat**

6.4.1.1 The driver / co-driver seat/ Front passenger seat shall meet the requirements specified in AIS-023, as amended from time to time.

6.4.2 **Passenger Seat requirements**

6.4.2.1 The passenger seats shall meet the requirements specified in AIS-023, as amended from time to time.

6.5 Power Operated Service Door

6.5.1 **Test Requirements**

6.5.1.1 The construction and control system of every power operated service door be such that a passenger is unlikely to be injured by the door or

trapped between the door while closing. The door system shall meet the requirements defined in para 6.5.1.2 & para 6.5.1.3.

6.5.1.2 The closing of the door at the measuring point is resisted by the clamping force not exceeding 150 N, the door shall reopen automatically to its fullest extent and remain open until a closing control is operated. The clamping force shall be measured using a test bar of section 60mm High 30mm Wide and rounded at corners (R=5mm). The clamping force may be measured by the method specified in 6.5.2 or by any other equivalent method specified by the test agency. The peak clamping force may be higher than 150 N momentarily provided that it does not exceed 300 N. Alternatively, if the door can be easily reopened by hand, if the clamping force measured does not exceed 80 N when the door is between 30 and 120 mm ajar, and 150 N when is between 120 mm and 400 mm ajar with the energy supply on.

6.5.1.3 Whenever the doors are closed onto an object; the door reopens automatically to its fullest extent and remain open until a closing control is operated or the wrist or finger can be extracted without risk or injury to the passenger using test bar specified below:

- Test bar shall be so constructed such that it shall be tapered at one end over a length of 300 mm from 30 mm to a thickness of 5 mm.

6.5.2 Guidelines for measuring the closing forces of Power operated Doors

6.5.2.1 The closing of power –operated door is a dynamic process. When a moving door hits an obstacle, the result is a dynamic reaction force, the history of which (in time) depends on several factors. (e.g. the mass of the door, acceleration, dimensions).

6.5.2.2 **Definitions**

6.5.2.2.1 Closing force F(t) is a time function, measured at the closing edges of the door (see para 6.5.2.3.2)

6.5.2.2.2 Peak forces Fp is the maximum value of the forces.

6.5.2.2.3 Effective force Fe is the average value of the closing force related to the pulse duration:

$$Fe = 1/T \int_{t_2}^{t_1} F(t)\, dt$$

6.5.2.2.4 Pulse duration T is the time between t1 and t 2 :

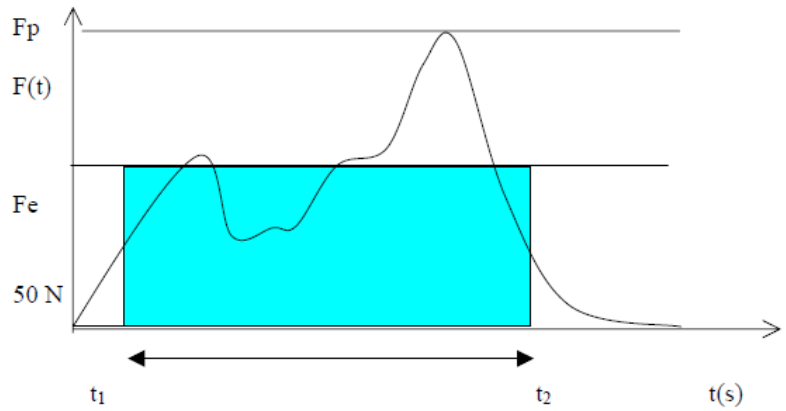
$T = t_1 - t_2$

Where

t_1 = threshold of sensitivity, where the closing force exceeds 50 N.

t_2 = fade away threshold, where the closing force becomes less than 50 N

This relation between the above parameters is shown below (as example only)



6.5.2.2.5 Clamping force Fc is the arithmetic mean value of the effective forces, measured at the same measuring point subsequently more times

$$Fc = \frac{\sum_{i=1}^{i=n} (Fe)_i}{n}$$

6.5.2.3 **Measurements**

6.5.2.3.1 Conditions of measurement

6.5.2.3.1.1 Temperature range 10 ° - 30 ° C.

6.5.2.3.1.2 The vehicle shall stay on a horizontal surface.

6.5.2.3.2 Measurement Points Shall be:

- At the main closing edge of the door,
- one in the middle of the door;
- one 150 mm above the lower edge of the door;

6.5.2.3.2.1 In case of the doors equipped with clamping prevention devices for the opening process; all the secondary closing edges of the door at the point which is considered to the most dangerous place of clamping.

6.5.2.3.3 At least three measurements shall be taken at each of the measuring points to determine the clamping force according to para 6.5.2.2.5.

6.5.2.3.4 The signal of the closing force shall be recorded by means of a low- pass filter with limited frequency of 100 Hz. Both the threshold of sensitivity and fade away threshold to limit the pulse duration shall be set at 50 N.

6.5.2.3.5 The deviation of the reading from the rated value shall not be more than ± 3%.

6.6 Door Components

6.6.1 Door and door components shall meet the standard specified in Rule 124 of CMVR, door locks shall meet requirements laid out in BIS Standards, Automotive Vehicles : locking systems and door retention components - general requirement IS 14225:1995, as amended from time to time and Automotive Vehicles Window retention and release system for buses - safety requirement as specified in 13944-1995, as amended from time to time.

6.6.2 **Door latch**

6.6.2.1 Door handle effort to unlatch the door shall be min. 30N and 55 N max. (optional specification).

6.6.2.2 Longitudinal Load *:* The door latch and striker assembly when tested as defined in IS 14225:1995 shall withstand a ultimate longitudinal load of 11 KN, when in fully latched position and 4.45 KN when in secondary latched position.

6.6.2.3 Transverse Load : The door latch and striker assembly when tested as defined in IS 14225:1995 shall withstand a ultimate transverse load of 8.9 KN, when in fully latched position and 4.45 KN when in secondary latched position.

6.6.2.4 Inertia *Load :* The door latch when contained in the door latched system (door latch, striker assembly, outside handle, key cylinder and connecting mechanism) and in fully latched position must remain in fully latched position when subjected to inertia load of 30 g in any direction. (ECE –R-42 & SAE J 839 July 82)

6.6.3 **Door Hinges**

6.6.3.1 Door hinge must be capable of withstanding an ultimate longitudinal load of 1135 Kgf and Transverse load of 910 Kgf.

6.6.3.2 *Longitudinal Load :* Door hinge system when subjected to test defined in SAE J July 82 shall be capable of withstanding an ultimate load of 11.1 KN.

6.6.3.3 *Transverse Load :*Door hinge system when subjected to test defined in SAE J 934 July 82 shall be capable of withstanding an ultimate load of 8.9 KN.

6.7 Electrical Conductor Test

6.7.1 **Principle**

6.7.1.1 This test consists of submitting specified test pieces of the electrical conductors, as installed in the vehicle, to a flame in order to evaluate their resistance to fire.

6.7.2 **Equipment**

6.7.2.1 The test equipment consists of:

6.7.2.1.1 **Test Enclosure**

6.7.2.1.1.1 The test enclosure consists of metallic screen with 3 faces:

- 1200 ± 25 mm height,
- 399 ± 25 mm width,
- 450 ± 25 mm depth.

The front face is open and the top and bottom is closed. The base not be metallic.

6.7.2.1.2 **Heat Source**

6.7.2.1.2.1 The heat source consists of a gas burner (Bunsen burner) of internal diameter between 9.5 mm and 10 mm. Its control is such that the length of the outer flame is approximately 125 mm and that of the inner flame approximately 40 mm.

6.7.2.1.2.2 The functioning of the burner is tested in the following manner: the base of the burner being horizontal, a naked copper wire of 0.71 ± 0.025 mm in diameter and having a free length of at least 100mm is introduced horizontally in to the flame, at 50mmabove the top edge of the wire is situated above the far vertical edge of the burner (see Fig. 9) the time necessary to melt the wire shall not exceed 6 seconds, nor be less than 4 seconds.

6.7.3 **Test Pieces**

6.7.3.1 The test piece is formed by a piece of conductor 600mm ± 25mm long.

6.7.4 **Test Method**

6.7.4.1 The test piece is held vertically and placed in the middle of the test enclosure such that its lower end is approximately 50 mm from the base of the enclosure. For the test, the base of the burner ,forms an angle of 45 deg. With the axis of the test piece. The distance between the burner and the test piece must be such that the inner flame just touches the centre line of the sample(see Fig. 10). The flame must be applied about 100 mm above the lower end of the test piece for a continuous period T (seconds) given by the formula:

$$T = 60 + M/25$$

Where M is the mass in grams of the test piece of conductor per length of 600 mm.

6.7.5 **Results**

6.7.5.1 The observed phenomena are recorded in the test report, notably:

- the duration of the combustion
- the length of the chared section.

6.7.6 **Classification**

6.7.6.1 Based on the results obtained, the material will be classified as follows:

Category 1: Combustion is self- extinguished.
The upper end of the test piece is intact.
Category 2: Combustion is self- extinguished.
The upper end of the test piece is charred or affected.
Category 3: Combustion is not self- extinguished.

6.7.7 **Acceptance Criteria**

6.7.7.1 Only Category 1 conductors are permitted.

6.8 Reserved

6.9 Illumination

6.9.1 **Method of Measurement:**

6.9.1.1 Reserved

6.9.1.2 For measurements of illumination as per Para 4.1.2.4.1.2.3 and Para 4.1.2.4.1.3.3, a lux meter shall be employed. After switching on the individual lighting devices, in as installed condition, the lux meter shall be placed at the location specified in Para 4.1.2.4.1.2.3 and Para 4.1.2.4.1.3.3 and then the lux values shall be noted. These lux values shall fall within the prescribed limits.

6.9.2 **Cabin Lighting**

6.9.2.1 The illumination by lighting devices lighting up the cabin interior - should be sufficient enough to clearly distinguishing each component part of the cabin. Driver should be in a position to read signages written on the walls, door of the cabin. He should also be in position to read any instructions printed on paper.

6.9.2.2 The following lamps are to fall in this category:

- Cab lamp or courtesy lamp
- Locker lamp
- Electrical distribution lamp

6.9.2.3 The luminous flux of all the lamps provided for cabin lighting to light up the equipment, components and to read, shall not be less than 30 lux and shall not be more than 150 lux, when measured at 500 mm above the driver seat base.

6.9.3 **Passenger area lighting**

6.9.3.1 The illumination by lighting devices lighting up the passenger area should ensure reading of signages inside the passenger area and other important signs like emergency signs. The illumination should light up handles, latches, knobs, rods, hand-holds, etc., facilitating easy access to passenger.

6.9.3.2 The following lamps are to fall in this category:-

- Entrance lamps
- Passenger area lamps

6.9.3.3 The illumination of these lamps to light up the entrance and exit for the passengers and in general to light up the passenger compartment shall not be less than 50 lux. Illumination in passenger compartment shall be measured at any seating location of the bus and at 500 mm above the seat base.

6.10 Test methods, procedures and requirements in respect of items not covered in this code shall be separately notified time to time.

Figure 1 (Reserved)
Figure 2 (Reserved)

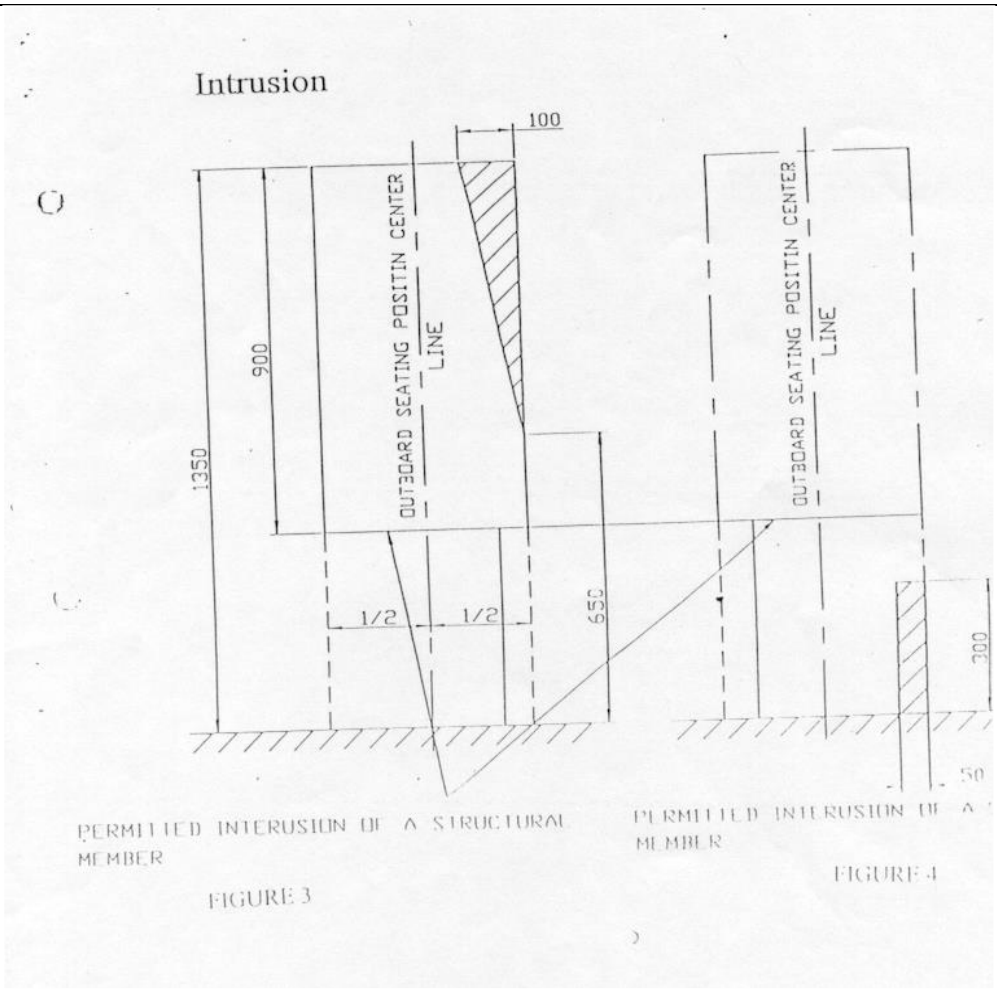

Intrusion
100
OUTBOARD SEATING POSITIN CENTER LINE
900
1350
1/2
1/2
650
OUTBOARD SEATING POSITIN CENTER LINE
300
50
PERMITTED INTERUSION OF A STRUCTURAL MEMBER
FIGURE 3
PERMITTED INTERUSION OF A MEMBER
FIGURE 4

Figure 4

Reserved

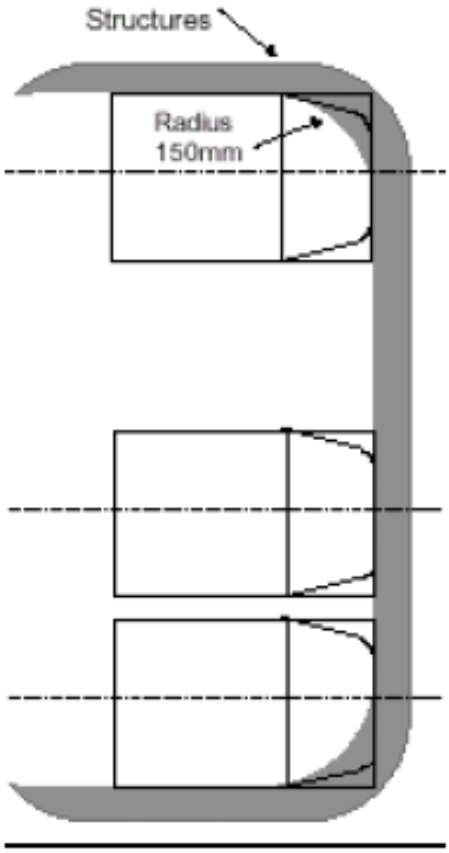


Figure 5

Permitted Intrusion at Rear Corner Seats View of the Prescribed Area of the Seat (Two seats at the Rear)

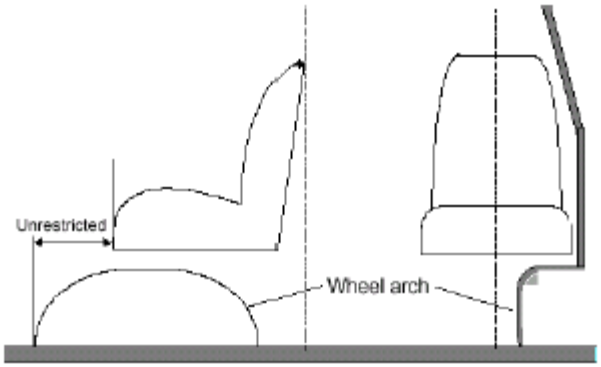


Figure 6

Permitted Intrusion of a Wheel Arch not extending beyond

the vertical centre line of the side seat
Figure 7 (Reserved)

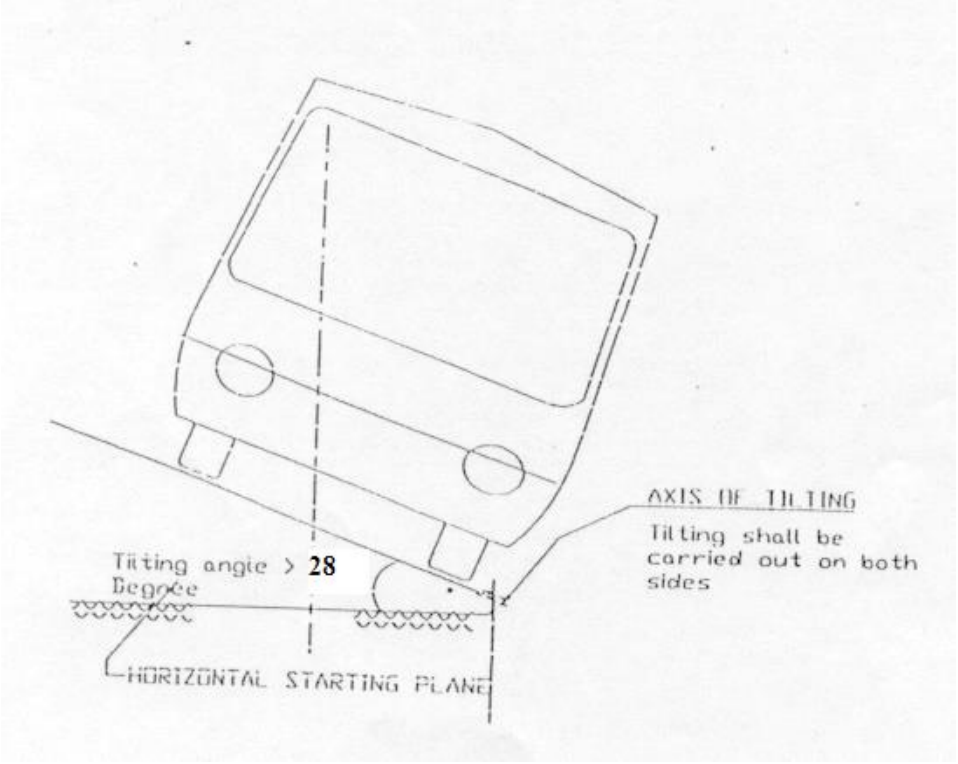



Figure 8 **Stability Test and Tilt angle**

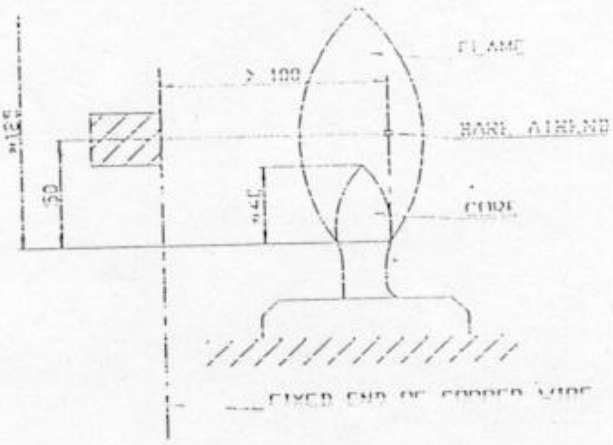


FIGURE 9

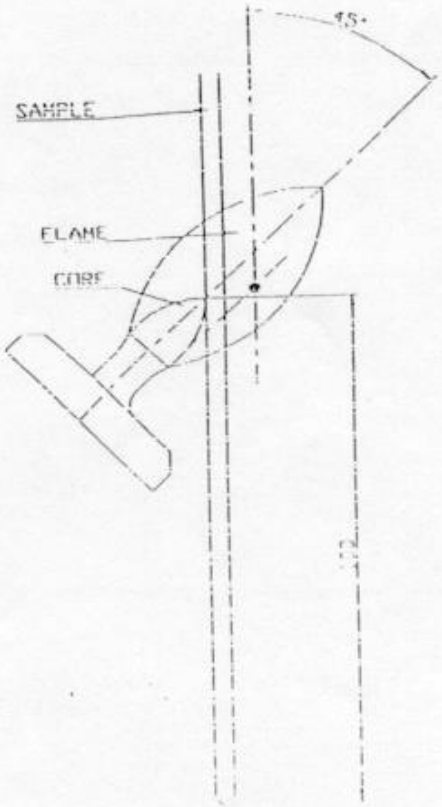


FIGURE 10

CHAPTER : 7

TYPE APPROVAL

7.1 SCOPE

7.1.1 The Type Approval Procedure specified in this code is applicable to buses with a seating capacity of 13 passengers or above.

7.1.2 Reserved

7.1.3 The system for approval of Prototype (Rule 126) and Conformity to production (Rule 126A) to comply with provisions with respect to the safety, strength and technical requirements specified in the **Bus body building code** shall be based on the standards notified from time to time.

7.2 Procedure for Type Approval

7.2.1 **The Type Approval shall be applicable to the following provisions for which compliance is sought by the vehicle manufacturer or Bus Body Builder as the case may be.**

(i) Complete Vehicle Type Approval (or)

(ii) Bus Body Type Approval as a separate unit (or)

(iii) Vehicle Type Approval fitted with the Bus Body which is already type approved

(iv) Prototype Type Approval of Vehicle and other aggregates / units

7.3 Application for Type Approval

7.3.1 The application for type approval shall be submitted to the test agency by the Vehicle Manufacturer / Bus Body Builder , with the description of the vehicle type (s) or body type (s) or the vehicle type fitted with an already approved body. This application shall be accompanied by the following documents, as applicable to the provisions for which compliance is sought.

a) List of provisions for which compliance is sought /to be established.

b) All the relevant information specified in the format **"**Information on Technical Specifications" to be submitted by Bus Body Builder given in Table 22 and 22A of AIS-007(Rev.5):2014.

c) Copies of certificates or test reports of compliance to various provisions, which may have already been obtained from other recognized Testing Agencies.

d) Copies of test reports for other models/variants, if any, which can be used for establishing compliance of the model to be type approved, with a note explaining the details.

e) Copy of certificate of incorporation of the manufacturer, if not already submitted.

f) Publications available.

7.3.2 In case of body builders, who have adopted any type tested designs provided by the chassis manufacturers, the body builder shall provide the necessary details and drawings of the chassis manufacturer, to the test agency for their consideration.

7.4 Type Approval of safety components / sub-assemblies

7.4.1 In addition to the safety components notified under Rule 124 of CMVR, 1989, the Type Approval of passenger seats and seat mountings, window sub-assembly, power operated service door, door components, etc shall be obtained.

7.5 Methods of Establishing Compliance

7.5.1 Depending upon the provision, the compliance can be established by either comparison of the values declared in the Technical Specifications with those in the provisions of CMVR, or checking the fitment of part(s) on the vehicle or by testing, as applicable. Applicability of rules, method of establishing the compliance and details of the test procedures shall be as specified in the bus body building code.

7.5.2 Criteria for extension of approvals for certification of bus models / variants.

S. No.	Parameters	Extension Criteria
1	Any change in the Category of Bus	• Separate application to be submitted by the manufacturer / bus builder.
2	Change in external and internal dimensions of bus	• Extension can be given to those clauses pertaining to dimensions, also considering the compliance to CMVR.
Seating Layout and Gangway		
3	Seats	• Can be extended based on AIS-023 report
4	Seating area	• To be verified for Maximum seating and Minimum standee. • To be verified for Maximum Standee and Minimum seating. • 2 X 2 seating layout with Maximum Gangway would be the worst case.
		• Increase in Overall Bus Width - No physical verification would be necessary. • Reduction of Overall bus Width - Physical verification would be necessary.
5	Any change in parameters of AIS-216 where in the requirements are based on other standards	• Change of such parameters can be considered for extension based on the reports complying to specified standards.
6	Door dimensions	• Minimum dimensions of the particular category would be the worst case. • Increase in number of doors - Physical verification would be necessary.

7	Internal height	• If height of bus remains the same, standee bus is worst, extension can be provided for non-standee.
		• If there is a decrease in the height of the bus, standee and non-standee provisions – Physical verification would be necessary.
Guard Rails		
8	Guard Rails	• Increase in guard rails more than 2 nos. - No physical verification would be necessary.
	Emergency exits	
9	Emergency exits / No. of emergency exits	• Increase in number of emergency exits, - Extension based on drawing. • Drawing showing the whole vehicle emergency plan.
	Steps	
10	Steps	• To be considered on case to case basis.
11	Step well	• Maximum depth of steps.
	Driver Work Area	
12	Driver work area	• In case of change in dimension of driver work area specification, physical verification would be necessary.
	Other Parameters	
13	Any change in parameters of AIS-216, where in the requirements are other standards, like corrosion protections, wiring harness, safety critical components like safety glass, horns, rear view mirrors, Door locks and hinges, fuel tanks, window frames, lighting and signaling devices, seat padding material and upholstery	• Change of such parameters can be considered for extension based on reports / compliance to specified component or system level standard.

14	If the bus body remains same and the chassis on which the bus is made changes	• Extension will be provided based on the worst case criteria. All measurements with reference to ground should be confirmed.

7.6 **Certificate of Compliance: (Type-approval)**

7.6.1 After compliance is established for all the provisions, applicable to that model/variant(s), a Certificate of Compliance consolidating all applicable provisions shall be issued by the Testing Agency. The Brief Technical Specifications as declared by the manufacturer (Table 22 of AIS-007 (Rev. 5): 2014) shall be counter signed by the Testing Agency and shall be attached to the certificate of compliance.

7.7 **Accreditation of Bus Body Builders**

7.7.1 All bus body building units shall be accredited by agencies notified by the Government. The accredited bus body building units shall meet the type approval requirements specified in para 7.2.

~~7.8~~ ~~**Non-conformity of Production**~~

~~7.8.1~~ ~~The accreditation granted to the Bus Body Building unit may be suspended or with drawn in case of non-conformity as per notified procedures for facility accreditation of Bus Body Builders, by the Ministry of Road Transport and Highways.~~

APPENDIX I

(See 3.2.23.2)

COMPUTER SIMULATION OF VIBRATION TEST TO FIND OUT LOWEST NATURAL FREQUENCY OF M2 & M3 BUS CATEGORY

1.0 ADDITIONAL DATA AND INFORMATION

The structure of M2 & M3 bus category need to meet the requirements specified in Paragraphs 3.23.1 of this standard by a computer simulation method approved by the testing agency. The following information shall be supplied to the testing agency:

1.1 3D CAD model of entire bus structure (chassis and superstructure) including drawings

1.2 Vehicle and aggregate mass details (Kerb and Laden weight)

1.3 Material properties of chassis and superstructure assemblies

1.4 Physically measured centre of gravity

1.5 Seat layout and standee floor clearly marked on the drawings

2.0 THE MATHEMATICAL MODEL

The model shall be built in such a way that it shall be capable of describing the real physical behaviour of the vehicle. The mathematical model shall be constructed, and assumptions prescribed, in such a way that the calculation gives conservative results. The model shall be built up with the following considerations:

2.1. The total mass and the centre of gravity position used in the mathematical model shall be identical to those of the vehicle to be approved.

2.2. The mass distribution in the mathematical model shall correspond to the vehicle to be approved.

2.3. The model should capture details of vehicle sprung mass only i.e. Vehicle Super structure and chassis without suspension.

3.0 REQUIREMENTS FOR SIMULATION AND COMPUTING

3.1. The vehicle model shall be in free-free condition i.e. without any boundary conditions

3.2. The vehicle shall be in laden condition with passenger weight of 75 kg which includes 68 kg of passenger weight and 7 kg of passenger luggage weight.

3.3 The passenger weight shall be added at seat location and standee location

3.4 Seat mass shall be lumped at 'H' point of the seat

3.5 Standee mass is to be lumped at 875mm from floor in vertical direction as per standee layout marked in the drawing

3.6 Natural frequency determination is to be performed using Finite Element Analysis (FEA) code. A description of the applied simulation and calculation method which has been utilised, and clear precise identification of the analysis software, including at least its commercial name and the version used shall be specified.

4.0 EVALUATION OF THE SIMULATION

4.1 First global mode of the vehicle structure need to be checked.

4.2 The modal displacements for superstructure and chassis to be seen together.

4.3. No panel or other part modes to be seen.

5.0 DOCUMENTATION

5.1. The report on the simulation shall contain the following information:

5.1.1. All the data and information stated in Paragraph 1.0 of this Annexure,

5.1.2. A drawing showing the mathematical model of the vehicle,

5.1.3. A statement of the values of kerb weight, Gross vehicle weight, vehicle CG, Number of seating and standee passenger

5.1.4. Material properties used for the vehicle

5.1.6. Plots or data which show in an appropriate way that the requirements specified in Paragraphs 3.23.1. of this standard are met. This requirement can be satisfied by the provision of a global displacement plot for superstructure and chassis together for first global mode.

5.1.7. A statement of whether, or not, the requirements specified in Paragraphs 3.23.1 of this standard have been met,

5.1.8. All the data and information necessary for the clear identification of the vehicle type, its superstructure, the mathematical model of the superstructure, and the calculation itself.

5.2. At the request of the testing agency, further information shall be provided and included in the report.

APPENDIX II
(See 3.24.1.1)

AUTOMOTIVE VEHICLES — INTERIOR VIBRATION — METHOD OF MEASUREMENT AND REQUIREMENTS

1.0	**REFERENCES**
	The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:
	1. IS 9211 : 2003 Terms and definitions of weights of road vehicles other than two and three wheeler (second revision) 2. IS 14272 : 2011 Automotive vehicles — Types - Terminology 3. IS 12832 : 2010 (Reaffirmed 2016)Automotive Vehicles — Interior Noise — Method Of Measurement And Requirements 4. Recommendatory Urban Bus Specifications (UBS) – II, April 2013, Ministry of Urban Development, Government of India 5. European Union (EU) Directive 2002/44/EC – Minimum health and safety requirements regarding the exposure of workers to the risk arising from physical agents (vibration) 6. IS 13276 (Part 1) : 2000 Mechanical Vibration and Shock - Evaluation of - Human Exposure to Whole Body Vibration
2.0	**MEASURED QUANTITIES**
	Root mean square (rms), Vibration levels in 'm/s^2' at different vehicle operating conditions.
3.0	**MEASURING INSTRUMENTS**
3.1	**Vibration Measurements**
	Tri-axial seat pad accelerometer shall be used for measuring the vibration level at driver and passenger seat location. Uni-axial accelerometer shall be used for measuring the vibration level at gangway. Accelerometer should capture at least frequency range 0.4 Hz to 80 Hz for human health, comfort and perception

	(please refer IS 13276 (Part1): 2000 – clause 1). Data shall be acquired in this frequency range for at least 1 minute or for 0.5 km distance for each speed. The accelerometer must be calibrated according to the manufacturer's instructions by means of an appropriate reference source.
3.2	**Speed Measurements**
	The engine speed and vehicle speed shall be determined with an accuracy of ±3 percent during testing.
4 .0	**TEST TRACK CONDITIONS**
	Test track conditions shall be as given below:
4.1	Interior vibration levels of motor vehicles are greatly influenced in general by the macro texture of Surface roughness of the road, with smooth road surfaces producing consistent interior levels.
	Accordingly, the test road shall be hard and as smooth and levelled as possible, without gaps or ripples or similar macro-texture of surface roughness which might contribute to the interior vibration levels of the motor vehicle.
	The surface shall be dry and free from snow, dirt, stones, leaves, etc.
4.2	The test track shall allow a steady speed to be maintained. It shall be in a straight line or form a closed circuit with at least 2 000 m length and having a minimum radius of 200 m. The measurement shall not be carried out on banking section of tracks. In case, if the length of the test track is shorter than above, then before carrying out test, it should be confirmed that such shorter test track is enough to achieve the required stabilized speed.
5.0	**VEHICLE CONDITIONS**
5.1	Engine and Tyre Conditions
	Prior to test, the vehicle shall be run-in as per vehicle manufacturers' recommendation. The vehicle's tyres must be of the type normally fitted to such vehicles by the manufacturer and must be inflated to the appropriate pressure(s) for the unladen vehicle. Before the measurements are made, the engine must be brought to its normal operating condition as regards temperatures, settings, fuel, spark plugs, carburetor(s), etc. (as appropriate).
5.2	**Loading of the Vehicle**
	The vehicle shall be tested in unladen condition. Only standard vehicle equipment, measuring equipment and necessary personnel shall occupy the interior of the vehicle. Not more than two persons (the driver and observer) shall be present, and in M3 category buses with more than eight seats not more

	than three persons may be present. For vehicles with drive-away chassis submitted for test, the compliance to 5.4.1 and 8 shall be established based on a prototype model/mock-up sample, representing completely built vehicle submitted by the vehicle manufacturer.
5.3	**Openings, Windows, Auxiliary Equipment, Adjustable Seats**
5.3.1	Openings such as skylights, all windows and ventilating inlets and / or outlets shall be shut if possible, Wherever the shutting is not possible, it shall be mentioned in report clearly.
5.3.2	Auxiliary equipment such as windscreen wipers, heating and/or ventilating fans and air conditioners shall not operate during the tests. If any auxiliary equipment is automatic in operation, its operating condition shall be stated in the test report.
5.3.3	Adjustable seats shall be set in the mid position of the horizontal and vertical range of adjustments.
5.4	**Vehicle Operating Conditions**
	The vehicle operating conditions shall be such as to typify the inside vibration under whichever of the following conditions are appropriate for the vehicle under test:
	a) Steady speeds (see 5.4.1);
	b) Full throttle acceleration (maximum accelerator position) (see 5.4.2); and
	c) Vehicle stationary, with engine idling and full throttle (see 5.4.3),
	as an additional monitoring test for commercial vehicles and buses with diesel engines. The corresponding operating conditions are specified in 5.4.1, 5.4.2 and 5.4.3.
5.4.1	Steady Speed
5.4.1.1	Test vehicle speed
	The test shall be carried out with increments of 20 km/h starting from 40 km/h to 80 percent of the maximum speed. If the maximum speed of the test vehicle is below 120 km/h, the test speed shall be 80 percent of its maximum speed. For a vehicle with the maximum vehicle speed below 40 km/h, the test shall be done at 80 percent of its maximum speed. The vehicle speed shall be maintained within ±3 percent of each test speed.
5.4.1.2	Gear position of transmission
	A single highest possible gear (including that of auxiliary transmission) that allows the stable running of the test vehicle shall be used. If the test vehicle is

	capable of selecting 4- wheel drive or 2- wheel drive the vehicle shall be run with the 2-wheel drive. Vibration levels are to be determined at least three speeds to cover the range specified above.
5.4.2	Full Throttle Acceleration (Maximum Accelerator Position)
	The procedure for the acceleration test is as follows:
	a) Speed of the vehicle and of the engine shall be stabilized at specified initial conditions;
	b) When stable conditions are attained, the throttle shall be fully opened as quickly as possible and vibration recording shall be made until either 90 percent of the engine speed for maximum power as specified by the manufacturer of the vehicle (in the following test, referred to as maximum power speed) or 120 km/h is reached, whichever is lower. Wheel slip shall be avoided.
	The initial operating conditions shall be specified as follows:
	a) Transmission setting shall be the highest position making the test possible without exceeding 120 km/h;
	b) Setting shall not be changed during the test;
	c) If, at an engine speed of 90 percent of maximum power speed, a road speed of 120 km/h is exceeded in top gear, a lower gear shall be selected, but no lower than third for a four-or five-speed gear-box, and no lower than second for a three-speed gearbox. If 120 km/h is still exceeded in this lower gear, the vehicle shall be tested over the speed range 60 to 120 km/h in that gear;
	d) If possible, kick-down mechanisms shall be made in-operative;
	e) Initial engine speed shall be the lowest allowing a continuously increasing engine speed during the test, but no lower than 45 percent of the maximum power speed, unless 120 km/h is exceeded at 90 percent of maximum power speed in the lowest gear allowed, in which case the initial engine speed shall be that corresponding to a road speed of 60 km/h;
	f) For vehicle with automatic transmission, the initial engine speed shall be stabilized as near as possible to 45 percent of the maximum power speed. The corresponding road speed shall be not higher than approximately 60 km/h.
	g) For vehicles with automated manual transmission, speed of the vehicle and of the engine shall be stabilized at specified initial conditions. When stable conditions are attained, the throttle shall be fully opened as quickly as possible and vibration recording shall be made until either 90 percent of the

	engine speed for maximum power as specified by the manufacturer of the vehicle or 120 km/h is reached, whichever is lower. Wheel slip shall be avoided.
	If, for vehicles with automatic transmissions, the setting changes before the final speed of 90 percent of maximum power speed of 120 km/h is reached the initial speed shall be 50 percent of that speed where the setting changes. NOTE — Since difficulties in controlling engine speeds may be encountered in vehicles fitted with torque converters, the test condition should be adhered to as closely as practicable.
5.4.3	Stationary Test
	The procedure for the stationary test which shall be carried out in neutral gear is as follows:
	a) Engine shall be operated at the low speed idle; and
	b) Throttle shall be fully opened as quickly as possible allowing the engine to accelerate to high idle and shall be held fully open for at least 5 second.
6.0	**ACCELEROMETER POSITIONS**
	The vibration inside a vehicle may vary considerably with location. Therefore, measuring points should be selected in sufficient number and in such a manner that the distribution of the vibration in the vehicle is adequately represented with respect to driver and passenger seating locations.
6.1	One measuring point shall be at the driver's seat. Additional measuring points shall be for the rear passenger seats of vehicle adjacent to the longitudinal axis of the vehicle.
6.2	For a vehicle with three or more than three rows of seats the interior vibration shall be measured with the accelerometer position at the following three positions. Driver's seat as the first position, second position at the middle row (in case of odd number of rows considering driver seat as the 1st row)and front seat out of the 2 middle seats (in case of even number of rows considering driver seat as the 1st row) of the multiple seat rows and third position at the last row of seats for the seat positions nearest to the longitudinal axis of the vehicle.
6.3	Similarly, for a vehicle with three or more than three rows of seats the gangway vibration shall be measured with the uni-axial accelerometer position at the following three positions. Front, middle and rear zone of the vehicle coving the entire length of the gangway.
6.4	During the measurement no person shall occupy the selected position with the exception of seat vibration locations. The accelerometers shall be mounted in the orientation of vehicle level Cartesian coordinates (XYZ).
6.5	Reserved

7.0	**TEST PROCEDURE**	
7.1	At the steady speeds, the values of the root mean square (rms) vibration level are recorded for at least three speeds as specified in 5.4.1.	
7.2	At full throttle acceleration (see 5.4.2), the maximum value of the overall vibration level occurring in the specified acceleration range is retained and stated in the test report.	
7.3	In the stationary test, the values of the root mean square (rms) vibration level shall be recorded when the testing is carried out as specified in 5.4.3.	
7.4	At least two measurements shall be made at each accelerometer position and for each operating condition. If the spread of results of the vibration levels obtained under any measuring condition exceeds 20% deviations, further measurements shall be made until the readings of two independent successive measurements fall within a range of 20%; the mean value of these two readings shall be recorded as the test result. The values stated in the test report shall be rounded to the nearest integral decibel.	
	Any peak which is obviously out of character with the general vibration level being read should be ignored.	
8.0	**TEST REPORT**	
	The test report shall include the following information:	
	Sr. No.	Parameters to be Included in Test Report
	i	Nature of tests
	ii	Test site
	iii	Measuring equipment
	iv	Vehicle details, including,
		a) its engine / motor b) settings of gearbox c) speed during tests d) tyre sizes e) tyre pressures f) radiator-flaps (blinds)
	v	Adjustable seats with reference to 6.3.3
	vi	Unladen weight of the vehicle

	vii	No. of persons in the vehicle
	viii	Accelerometer positions
	ix	The root mean square vibrations level at specified accelerometer positions
9.0	**TECHNICAL SPECIFICATIONS OF VEHICLE TO BE SUBMITTED BY THE VEHICLE MANUFACTURER**	
	The technical specification of vehicle as relevant to interior vibration shall be declared by vehicle manufacturer and shall contain at least the following:	
	a) Model name/Variant(s) b) Category of vehicle c) Unladen weight d) Fully built or partially built or only with cabin e) Setting of gear box i) Type of gear box — MT/AT/CVT ii) No. of forward gears iii) Maximum speeds in different gear iv) Transmission ratio v) Axle ratios	
	f) Engine / Motor: power-torque characteristics i) Engine / Motor type ii) Capacity iii) Number of arrangement of cylinders iv) Fuel used	
	g) Tyre sizes and tyre pressures	
	h) Interior length / seating layout	
	NOTE — If the specifications submitted for complete type approval of a vehicle contain the details given above, there is no necessity of submitting this information again	
10 .0	**MODIFICATIONS/CHANGES**	

	In case test is conducted for verification of compliance to statutory requirements the following procedure shall be followed:
10.1	Every functional modification pertaining to the information declared in accordance with 9 shall be intimated by the manufacturer to the certifying agency. The Testing Agency may then consider, whether, the model with the changed specifications still complies with provisions; or any further verification is required to establish compliance. For considering whether any further verification is required or not, guidelines given in 11.0 may be followed.
10.2	In case of any further verification is required to establish compliance, tests for only those parameters which are affected by the modifications need to be carried out.
10.3	In case of fulfillment of results of further verification as per 10.2, the approval of compliance shall be extended for the changes carried out.
10.4	These conditions are applicable irrespective of any change in commercial name of the vehicle model.
11.0	**CRITERION FOR EXTENSION OF APPROVAL (CEA)**
11.1	This clause gives the factors to be considered while selecting a vehicle to represent a range of variants for establishing compliance of a model for type approval to meet the test requirements of 8 for test conducted as per 5.4.1
	This also applies to,
	a) Extension of type approval for changes in technical specifications of an already type approved model; and
	b) Establishing compliance of new model / variant (s) based on already type approved model.
11.2	In case of following changes, the verification shall be carried out for establishing compliance of the changes parameters to the requirements specified in this standard. The following is applicable only for the verification as per 5.4.1
11.2.1	In case of change in engine type, capacity, number and arrangement of cylinders, test needs to be conducted for compliance.
11.2.1.1	In case of change in base diesel engine to petrol, CNG or LPG or base petrol engine to CNG or LPG keeping the power within the tolerance specified below, no test needs to be conducted for compliance.
11.2.2	In case of increase in rated engine power up to 10 percent or any decrease of rated engine power, no test needs to be conducted for compliance;
11.2.3	In case of increase in rated engine speed up to 10 percent or any decrease of rated engine speed, no test needs to be conducted for compliance.

11.2.4	In case of any changes in transmission ratios, axle ratios and type, size and ply rating of tyres, no test needs to be conducted for compliance.
11.2.5	In case of any increase in the interior length or a decrease in interior length by less than 10 percent, no test needs to be conducted for compliance;
11.2.6	In case of any decrease in the maximum fan tip speed or an increase in the fan tip speed up to 10 percent, no test needs to be conducted for compliance.
11.2.7	In case of any decrease in the blades or an increase in the number of blades up to 30 percent (rounded off to nearest whole number, as per Indian Standard), no test needs to be conducted for compliance;
11.2.8	In case of change in the fan drive from mechanical to either viscous or electrical or from viscous to electrical, no test needs to be conducted for compliance.
11.2.8.1	In case of any change in fan shroud, blade material, thickness, profile and design details, no test needs to be conducted for compliance;
11.3	Changes other than the above are considered as not affecting compliance and do not call for any test.

APPENDIX III

(See -**3.25.1.3**)

AUTOMOTIVE VEHICLES — INTERIOR HARSHNESS — METHOD OF MEASUREMENT AND REQUIREMENTS

1.0	**REFERENCES**
	The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:
	1. IS 9211 : 2003 Terms and definitions of weights of road vehicles other than two and three wheeler (second revision)
	1. IS 14272: 2011 AUTOMOTIVE VEHICLES — TYPES — TERMINOLOGY
	2. Recommendatory Urban Bus Specifications (UBS) – II, April 2013, Ministry of Urban Development, Government of India
	3. IS 13276 (Part 1) : 2000 Mechanical Vibration and Shock - Evaluation of - Human Exposure to Whole Body Vibration
	4. IRC: 99-1988 : Tentative Guidelines on the Provision of Speed Breakers for Control of Vehicular Speeds on Minor Roads.
	5. IS 12832 : 2010 (Reaffirmed 2016) Automotive Vehicles — Interior Noise — Method Of Measurement And Requirements.
2.0	**MEASURED QUANTITIES**
	Transient (running rms) Vibration levels at driver and passengers seating area in ‘g’.
3.0	**MEASURING INSTRUMENTS**
3.1	**Vibration Measurements**
	Tri-axial seat pad accelerometer shall be used for measuring the vibration level at driver and passenger seat locations. Accelerometer should capture at least frequency range 0.4 Hz to 80 Hz for human health, comfort and perception (Please refer IS 13276 (Part1): 2000 – clause 1). At the beginning and end of each series (full set) of measurements, the accelerometer must be calibrated according to the manufacturer’s instructions

	by means of an appropriate reference source.
3.2	**Speed Measurements**
	The vehicle speed shall be determined with an accuracy of ±3 percent during testing.
4 .0	**TEST TRACK CONDITIONS**
	Test track conditions shall be as given below:
4.1	Interior vibration levels of motor vehicles are greatly influenced in general by the macro texture of Surface roughness of the road, with smooth road surfaces producing consistent interior levels.
	Accordingly, the test road shall be hard and as smooth and levelled as possible, without gaps or ripples or similar macro-texture of surface roughness which might contribute to the interior vibration levels of the motor vehicle.
	The surface shall be dry and free from snow, dirt, stones, leaves, etc.
4.2	The test track shall allow a steady speed to be maintained. It shall be in a straight line with at least 2000 m length and having a minimum radius of 200 m. The measurement shall not be carried out on banking section of tracks.
5.0	**VEHICLE CONDITIONS**
5.1	**Engine and Tyre Conditions**
	Prior to test, the vehicle shall be run-in as per vehicle manufacturers' recommendation. The vehicle's tyres must be of the type normally fitted to such vehicles by the manufacturer and must be inflated to the appropriate pressure(s) for the unladen vehicle. Before the measurements are made, the engine must be brought to its normal operating condition as regards temperatures, settings, fuel, spark plugs, carburetor(s), etc. (as appropriate).
5.2	**Loading of the Vehicle**
	The vehicle shall be tested in unladen condition. Only standard vehicle equipment, measuring equipment and necessary personnel shall occupy the interior of the vehicle. Not more than two persons (the driver and observer) shall be present, and in M3 category buses with more than eight seats not more than three persons may be present. For vehicles with drive-away chassis submitted for test, the compliance to 6.4 and 8.0 shall be established based on a prototype model/mock-up sample, representing completely built vehicle submitted by the vehicle manufacturer.
5.3	**Openings, Windows, Auxiliary Equipment, Adjustable Seats**
5.3.1	Openings such as skylights, all windows and ventilating inlets and / or outlets shall be shut if possible, wherever the shunting is not possible, it shall be

	mentioned in report clearly.
5.3.2	Auxiliary equipment such as windscreen wipers, heating and/or ventilating fans and air conditioners shall not operate during the tests. If any auxiliary equipment is automatic in operation, its operating condition shall be stated in the test report.
5.3.3	Adjustable seats shall be set in the mid position of the horizontal and vertical range of adjustments.
5.4	Vehicle Operating Conditions
	Vibration levels at driver and passenger seat locations shall be measured while the vehicle is accelerated from minimum possible speed to maximum possible speed or 80 kmph whichever is lower, in single highest gear and decelerated to minimum speed in the same gear. A single highest possible gear (including that of auxiliary transmission) that allows the stable running of the test vehicle shall be used. If the test vehicle has a drive train selectable between 4- wheel drive or 2- wheel drive the vehicle shall be run with the 2- wheel drive.
6.0	**ACCELEROMETER POSITIONS**
	The vibration inside a vehicle may vary considerably with location. Therefore, measuring points should be selected in sufficient number and in such a manner that the distribution of the vibration in the vehicle is adequately represented with respect to driver and passenger seating locations.
6.1	One measuring point shall be at the driver's seat. Additional measuring points shall be for the rear passenger seats of vehicle adjacent to the longitudinal axis of the vehicle.
6.2	For a vehicle with three or more than three rows of seats the interior vibration shall be measured with the accelerometer position at the following three positions. Driver's seat as the first position, second position at the middle row (in case of odd number of rows considering driver seat as the 1st row) and front seat out of the 2 middle seats (in case of even number of rows considering driver seat as the 1st row) of the multiple seat rows and third position at the last row of seats for the seat positions nearest to the longitudinal axis of the vehicle.
6.3	During the measurement no person shall occupy the selected position with the exception of seat vibration locations. The accelerometers shall be mounted in the orientation of vehicle level Cartesian coordinates (XYZ).
7.0	**TEST PROCEDURE**
	Vibration level at driver and passenger seat locations shall be measured while the vehicle is accelerated from minimum possible speed to maximum possible speed or 80 kmph whichever is lower, in single highest gear and decelerated to minimum speed in the same gear. At least two measurements shall be made at each accelerometer position. If the speed of results of the vibration levels

	obtained under any measuring conditions exceeds 20% deviations, further measurements shall be made until the readings of two independent successive measurements fall within a range of 20% the mean value of those two readings shall be recorded as the test result. The values stated in the test report shall be rounded to the nearest integral decibel. Any peak which is obviously out of character with the general vibration level being read should be ignored.	
8.0	**TEST REPORT**	
	The test report shall include the following information:	
	Sr. No.	Parameters to be Included in Test Report
	i	Nature of tests
	ii	Test site
	iii	Measuring equipment
	iv	Vehicle details, including,
		a) its engine / motor
		b) settings of gearbox
		c) speed during tests
		d) tyre sizes
		e) tyre pressures
		f) radiator-flaps (blinds)
	v	Adjustable seats with reference to 6.3.3
	vi	Unladen weight of the vehicle
	vii	No. of persons in the vehicle
	viii	Accelerometer positions
	ix	The maximum transient vibration level at specified accelerometer positions
9.0	**TECHNICAL SPECIFICATIONS OF VEHICLE TO BE SUBMITTED BY THE VEHICLE MANUFACTURER**	
	The technical specification of vehicle as relevant to interior vibration shall be	

	declared by vehicle manufacturer and shall contain at least the following:
	a) Model name/Variant(s)
	b) Category of vehicle
	c) Unladen weight
	d) Fully built or partially built or only with cabin
	e) Setting of gear box
	i) Type of gear box — MT/AT/CVT ii) No. of forward gears iii) Maximum speeds in different gear iv) Transmission ratio v) Axle ratios
	f) Engine / Motor : power-torque characteristics
	i) Engine / Motor type ii) Capacity iii) Number of arrangement of cylinders iv) Fuel used
	g) Tyre sizes and tyre pressures
	h) Interior length / Seating Layout
	NOTE — If the specifications submitted for complete type approval of a vehicle contain the details given above, there is no necessity of submitting this information again
10	**MODIFICATIONS/CHANGES**
	In case test is conducted for verification of compliance to statutory requirements the following procedure shall be followed:
10.1	Every functional modification pertaining to the information declared in accordance with 9 shall be intimated by the manufacturer to the certifying agency. The Testing Agency may then consider, whether, the model with the changed specifications still complies with provisions; or any further verification is required to establish compliance. For considering whether any further verification is required or not, guidelines given in 11 may be followed.
10.2	In case of any further verification is required to establish compliance, tests for only those parameters which are affected by the modifications need to be carried out.

10.3	In case of fulfillment of results of further verification as per 10.2, the approval of compliance shall be extended for the changes carried out.
10.4	These conditions are applicable irrespective of any change in commercial name of the vehicle model.
11.0	**CRITERION FOR EXTENSION OF APPROVAL (CEA)**
11.1	This clause gives the factors to be considered while selecting a vehicle to represent a range of variants for establishing compliance of a model for type approval to meet the test requirements of 3.25 for test conducted as per 5.4.1
	This also applies to,
	a) Extension of type approval for damage in technical specifications of an already type approved model; and
	b) Establishing compliance of new model / variant (s) based on already type approved model
11.2	In case of following changes, the verification shall be carried out for establishing compliance of the changed parameters to the requirements specified in this standard. The following is applicable only for the verification as per 5.4.1
11.2.1	In case of change in engine type, capacity, number and arrangement of cylinders, test needs to be conducted for compliance.
11.2.1.1	In case of change in base diesel engine to Petrol, CNG or LPG or base petrol engine to CNG or LPG keeping the power within the tolerance specified below, no test needs to be conducted for compliance.
11.2.2	In case of increase in rated engine power up to 10 percent or any decrease of rated engine power, no test needs to be conducted for compliance;
11.2.3	In case of increase in rated engine speed up to 10 percent or any decrease of rated engine speed, no test needs to be conducted for compliance.
11.2.4	In case of any change in transmission ratios, axle ratios and type, size and ply rating of tyres, no test needs to be conducted for compliance;
11.2.5	In case of any increase in the interior length or a distance in interior length by less than 10 percent.
11.2.6	In case of any decrease in the maximum fan tip speed or an increase in the fan tip speed up to 10 percent, no test needs to be conducted for compliance
11.2.7	In case of any decrease in the blades or an increase in the number of blades up to 30 percent (rounded off to nearest whole number, as per Indian Standard), no test needs to be conducted for compliance;
11.2.8	In case of change in the fan drive from mechanical to either viscous or electrical or from viscous to electrical, no test needs to be conducted for

	compliance.
11.2.8.1	In case of any change in balde material, thickness, profile and design details, blade material, thickness, profile and design details, no test needs to be conducted for compliance. For fan shroud minor changes like local profile/ depression (required for packaging) are allowed, except in the fan area;
11.3	Changes other than the above are considered as not affecting compliance and do not call for any test.

APPENDIX IV

(See clause 5.6.1)
Multiplexing Nodes Architecture Requirements

1.0	Architecture Node
a	Each node with its own microprocessor (16 bit minimum)
b	Internal communication on CAN 2B
c	At least one node shall have outputs suitable for
	i Resistive loads, Coil loads, relay loads PWM
	ii Current measurement, short circuit detection, open load detection and over Current Protection.
	iii Digital high / low side
d	At least one node shall have Inputs suitable for
	(1) Analog
	(2) Digital high/low side
	(3) for frequency/pulse counting
e	Each multiplexing node shall comply with standards as specified in Table 1 below.

Table 1

Sr. No	Test standards compliance	Specifications
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
2	**Cold**	IS 9000 (Part II/Sec 4)-1977 (reaffirmed 2004) at -15ºC for 2 hours in 'on' condition
3	**Dry heat**	IS 9000 (Part III/Sec 5)-1977: PIS Signs, SCU and Nodes at + 80ºC for 16 hours in 'on' condition. BDC at + 80ºC for 2 hours
4	**Damp heat**	IS 9000 (Part V/Sec 2)1981 at +25ºC /+55ºC, 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	**Vibration standard** **AIS 012/AIS:062 -10g**	Frequency 5~ 55 Hz and return to 5Hz at a linear sweep period of 1 minute/complete sweep cycle with 1.65 mm pk-pk displacement and maximum acceleration of 10g. Test duration 60 minutes Direction of vibration –X, Y, Z axis of device as it is mounted on the vehicle. For 10 g acceleration, frequency range need to be 5-55 Hz
6	**Dust and Water Ingress protection**	IS / IEC 60947-1:2004 in conjunction with IS/IEC 60259:2001, nodes IP54
7	**Free fall**	IS 9000 (Part VII/Sec 4) Free fall at 500 mm ,(applicable to 'nodes' and 'controllers'(only)
8	**Fire resistant**	Regulation directive 95-28/EG dated 24-10-1995 horizontal Burning rate tested as per ISO 3795. Horizontal burning test HB as per UL 94 -1998 clause 7 (for wire harness)
9	Reverse Polarity Protection	The component must fulfil the function- and service life requirements after being subjected to reversed polarity up to 27 V for 2 minutes.
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.
11	**Insulation resistance**	Insulation resistance test will be carried out after completion of 'Damp Heat Test' and then test samples to be kept at room temperature for atleast 0.5 hrs.
12	**Load dump test on**	123V , 8 Ohms 200ms pulse 5a as per standard

	controller	ISO 7637-2:2004 After test DUT shall meet at least class B as per ISO 7637-2:2004
13	**Salt spray test**	**(AIS: 012/ IS10250) 96 hours**
14	**EMC/EMI as per AIS 004 (Part 3)**	1.Electromagnetic radiation, radiated immunity and compatibility as per AIS 004 (Part 3) or 2.72/245/EEC last amended by 2009/19/EC (includes 2004/104/EC, 2005/83/EC, 2006/96/EC) and UN ECE Regulation Number 10 Rev 3:2008
		Note: In case of product is 'e' marked and a detailed test report is submitted (which includes above tests) no fresh verification is necessary
15	**Operating parameters**	Supply voltage 24 V± 25%

APPENDIX V

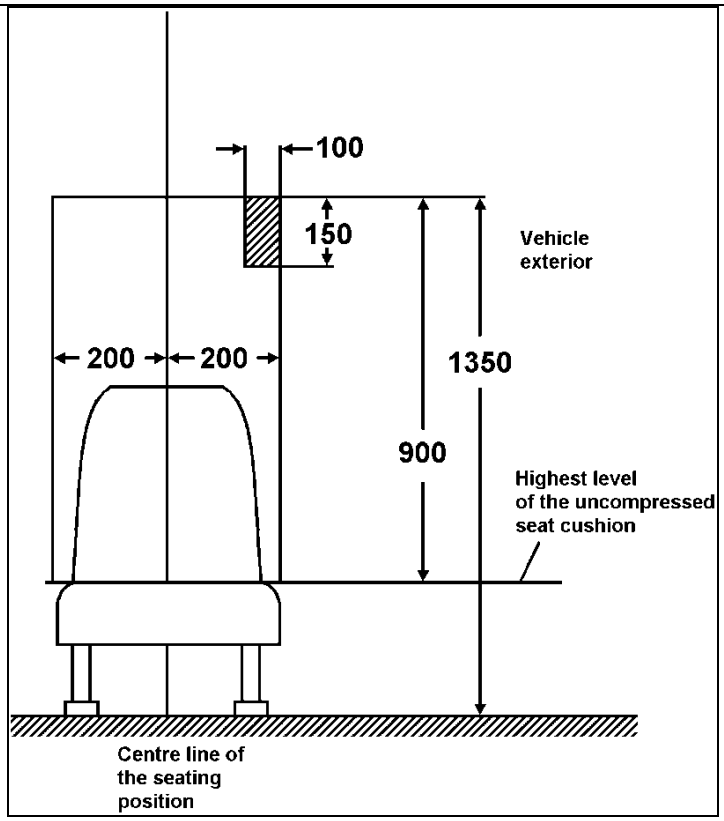
(See 2.2.19.6)

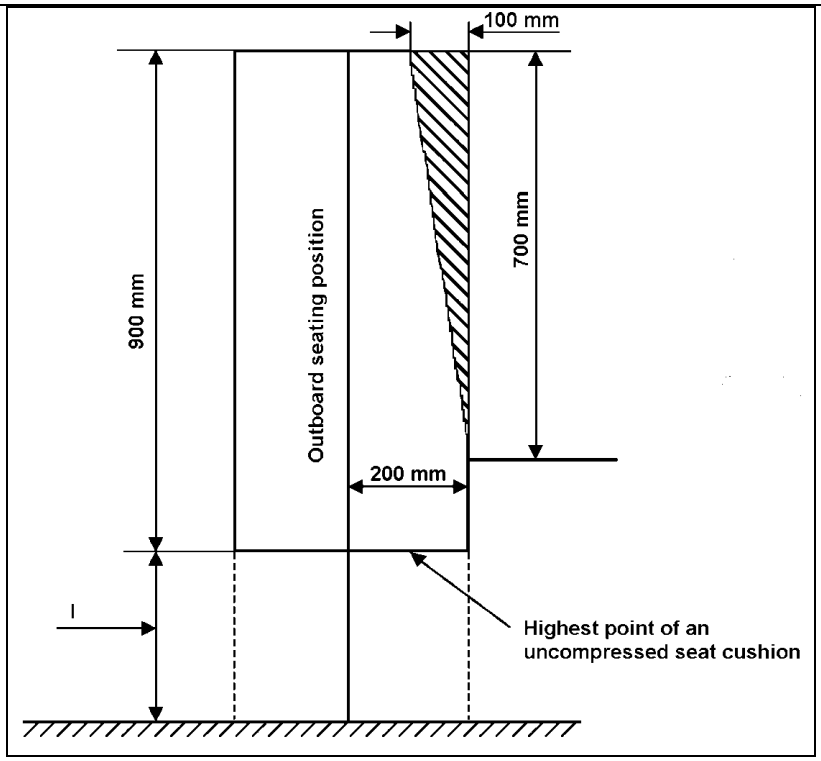
ACCOMODATION AND ACCESSIBILITY FOR PASSENGERS WITH REDUCED MOBILITY

1.0	**GENERAL**
	This annexure contains the provisions which apply to a Type -1, Bus of any floor height designed for easy access for passengers with reduced mobility and wheelchair users.
2.0	**SCOPE**
	These requirements shall apply to buses permitting easier access for persons with reduced mobility.
3.0	**REQUIREMENTS**
3.1	**Steps**

	The height of the first step from the ground of at least one service door shall not exceed 250 mm. for standard buses and ~~300 mm~~ for mini & midi buses. In the case where only one service door meets this requirement there shall be no barrier or sign which prevents that door from being used as both an entrance and an exit. In buses either a kneeling system and/or a retractable step may be engaged. The height of steps in an access passage at the above-mentioned door(s), and throughout the entire gangway, shall be not more than 200 mm for buses. The transition from a sunken gangway to a seating area shall not be considered to be a step.
3.2	**Priority Seats and Space for Passengers with Reduced Mobility**
3.2.1	Seats shall be either forward, side facing or rearward facing and shall be situated in a position near to a service door(s) suitable for boarding and alighting and compliant with Paragraph 3.1. above.
3.2.2	There may be adequate space for a guide dog under, or adjacent to, at least one of the priority seats. This space shall not form a part of the gangway.
3.2.3	Armrests shall be fitted on seats between the seating position and the gangway and shall be capable of being moved easily out of the way to permit clear access to the seat. In the case of seats facing each other, one of the gangway seats may alternatively be fitted with a vertical stanchion. This stanchion shall be positioned so that the seat occupant is kept securely on the seat and easy access to the seat is possible.
3.2.4	The minimum width of a priority seat cushion, measured from a vertical plane passing through the centre of that seating position, shall be as per AIS:216 as amended from time to time

3.2.5	The height of the uncompressed seat cushion relative to the floor shall be such that the distance from the floor to a horizontal plane tangent to the front upper surface of the seat cushion is between 400 mm and 500 mm.
3.2.6	The foot space at priority seating positions shall extend forward of the seat from a vertical plane through the forward edge of the seat cushion. The foot space shall not have a slope in any direction of more than 8%. The vertical distance between the floor of the seating area and the adjacent gangway shall be not more than 250 mm.
3.2.7	Each priority seating position shall have a free height of not less than 1,300 mm for buses of Type I, measured from the highest point of the uncompressed seat cushion. This free height shall extend over the vertical projection of the minimum required seat width of 440 mm and the associated footspace.
	Intrusion of a seat back or other object into this space shall be permitted provided that a minimum clear vertical space extending 230 mm in front of the seat cushion is maintained. Where the priority seat is positioned facing a

	bulkhead more than 1,200 mm in height this space shall be 300 mm. From the edges of the free space defined above, intrusions are permitted in accordance with paragraphs 3.2.7.1 to 3.2.7.4 of this Annexure as if reference to the clear space in Paragraphs 3.2.7.5 and 3.2.7.6 of this Annexure is a reference to the clear space defined above. The provisions of Paragraph 3.2.7.7 of this Annexure may apply. Intrusions of handholds or handrails as mentioned in Paragraph 3.4.2. below may protrude by a maximum of 100 mm from the sidewall into the clear space over the vertical projection of the foot space.
3.2.7.1	In the case of the upper part of the outboard seats, adjacent to the inner wall of the bus, a zone with a rectangular cross-section 150 mm in height and 100 mm in width (See Fig.1 to this Annexure).
	 **Figure 1** **Permitted Intrusion into Space above Seat Transversal Section of the Minimum Free Space above a Seating Place Adjacent to the Wall of the Bus**
3.2.7.2	In the case of the upper part of outboard seating position, a zone with triangular cross-section whose apex is situated 700 mm from the top and whose base is 100 mm in width (See Fig. 2 to this Annexure). The space needed for safety belts and their anchorages and for the sun visor is also excluded.

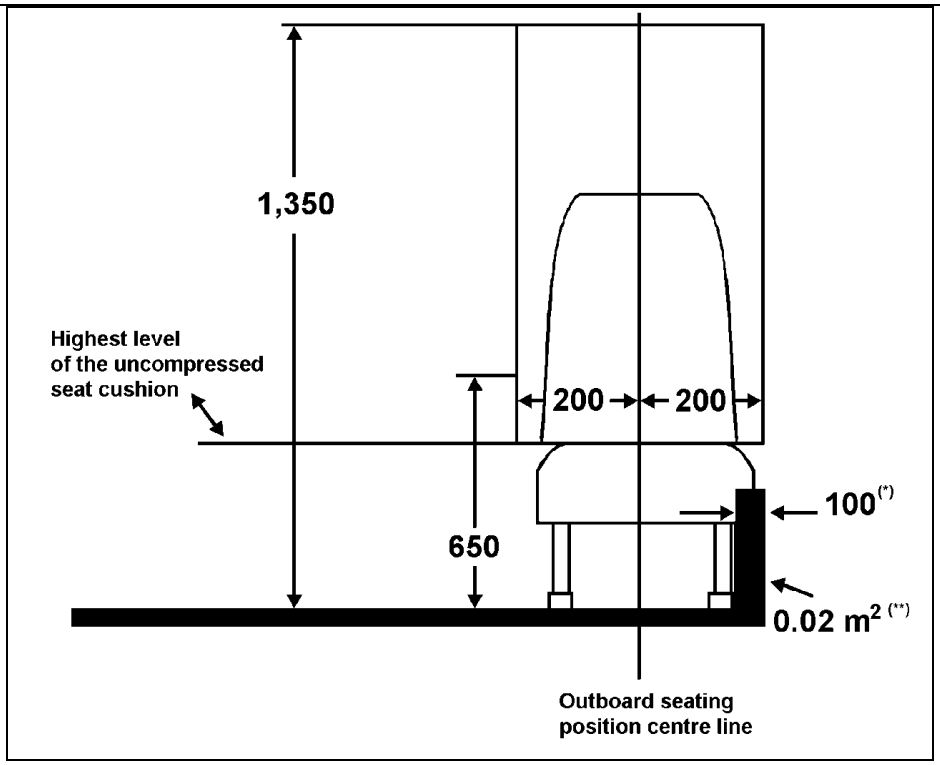


I (mm)
400 to 500 (for Classes A, B, I and II min 350mm at wheel arches and engine compartment(s))

Figure 2

Permitted Intrusion above a Seating Position

3.2.7.3	In the case of the foot well of an outboard seating position, a zone of a cross-sectional area not exceeding, $0.02m^2$ ($0.03m^2$ for low floor buses) and having a maximum width not exceeding 100 mm (150 mm for low floor buses) (See Fig.3 to this Annexure).

	
	(*) 150mm in the case of low-floor buses. (**) 0.03m^2 in the case of low floor buses.
	Figure 3 **Permitted Intrusion in Lower Part of Passenger Space**
3.2.7.4	In the case of a bus for up to 22 passengers, in the case of the seating places nearest to the rear corners of the body, the outer rear edge of the free space, viewed in plan, may be rounded to a radius not exceeding 150 mm (See Fig.4 to this Annexure).

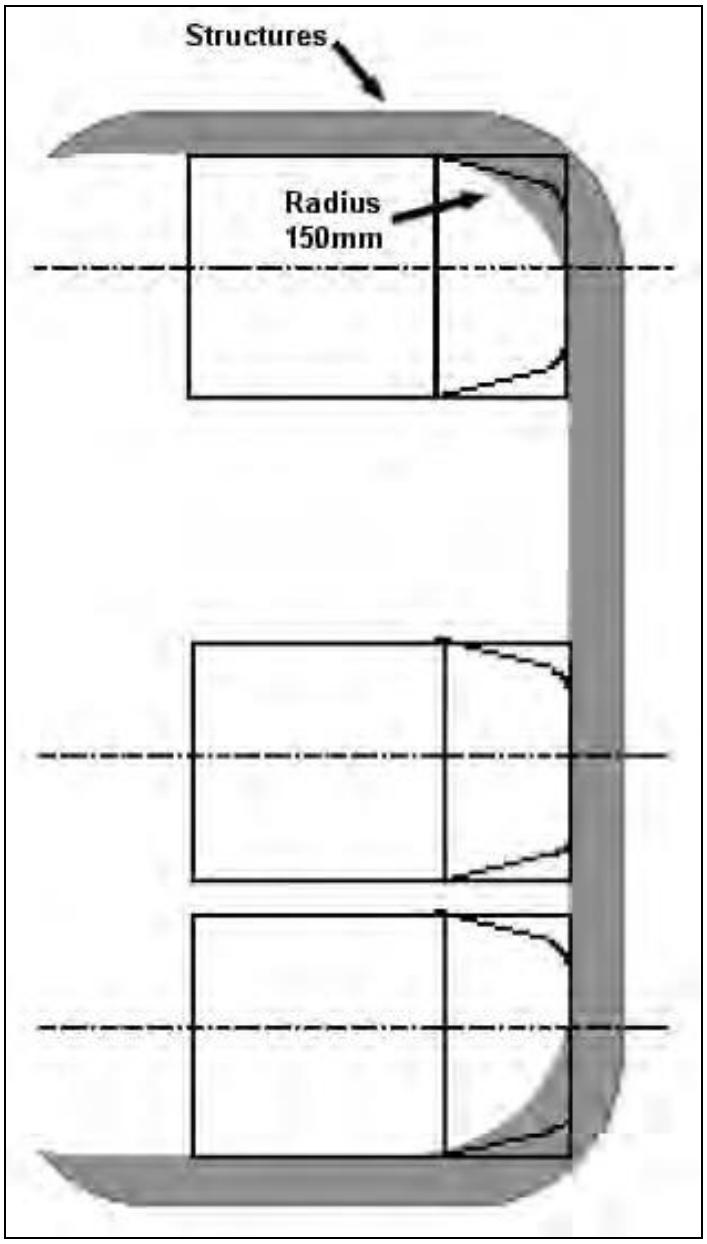


Figure 4
Permitted Intrusion at Rear Corner Seats
View of the Prescribed Area of the Seat
(Two Side Seats at the Rear)

3.2.7.5	In the case of single deck buses, over each seating position and, except in the case of the seat(s) alongside the driver in a bus with mini capacity, its associated foot space, there shall be measured a free space with a height of not less than 900 mm measured from the highest point of the uncompressed seat cushion and at least 1,350 mm from the mean level of the floor in the foot space. In the case of buses to which Paragraphs 2.2.6, 2.2.8 and 2.2.11 of this standard applies and also for the seat(s) alongside the driver in a bus of mini capacity or Midi or Standard capacity , these dimensions may be reduced to 1,200mm measured from the floor and 800mm measured from the highest point of the uncompressed seat cushion.
3.2.7.6	This free space shall be extended over the zone defined:
3.2.7.6.1	By longitudinal vertical planes 200mm either side of the median vertical plane of the seating position, and
3.2.7.6.2	By a transverse vertical plane through the rearmost upper point of the seat back and by a transverse vertical plane 280mm in front of the foremost point of the uncompressed seat cushion, measured in each case at the median vertical plane of the seating position.
3.2.7.7	For buses having a capacity not exceeding 22 passengers, in the case of seats adjacent to the wall of the bus, the available space does not include, in its upper part, a triangular area 20mm wide by 100mm high (See Fig.5 to this Annexure). In addition, the space needed for safety belts and their anchorages and for the sun visor should be considered as exempted.

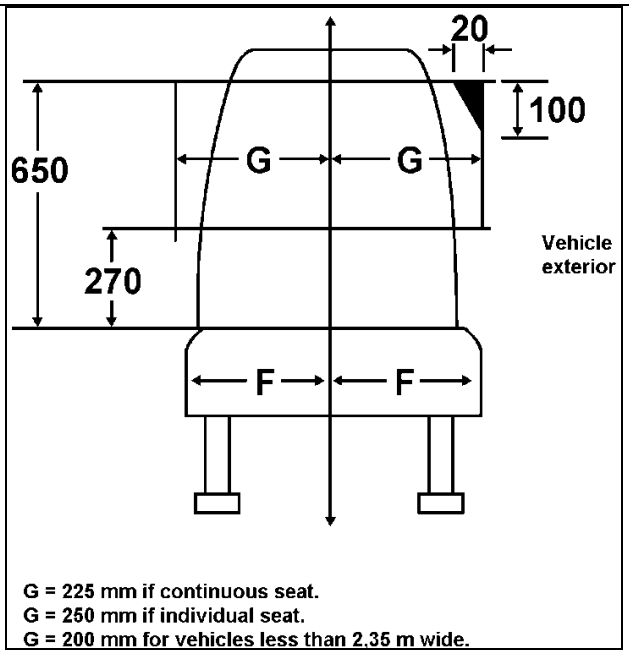
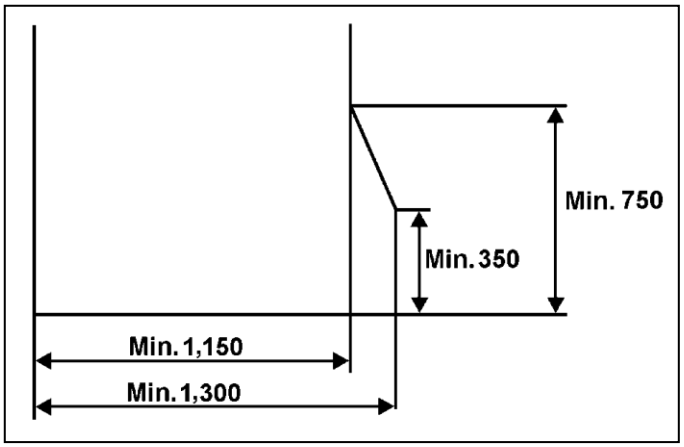


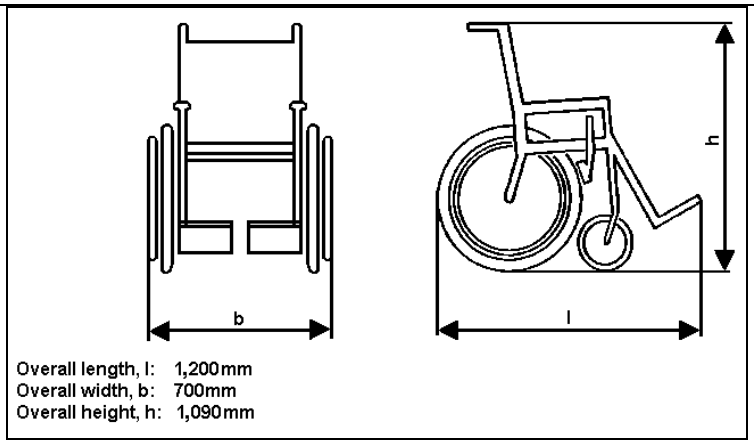
Figure 5

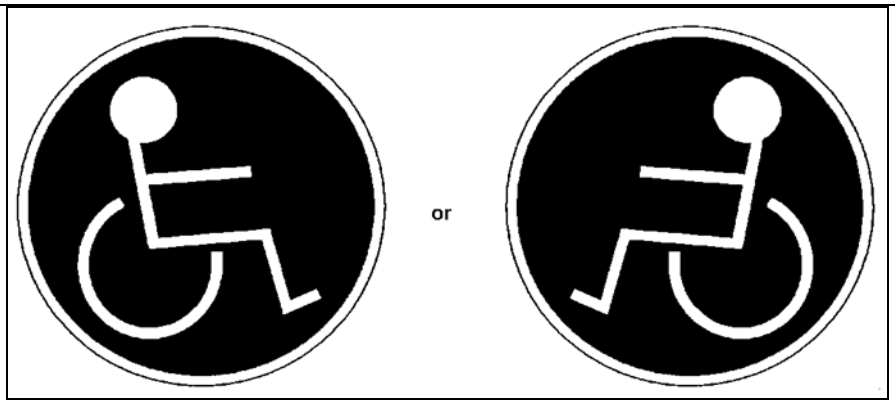
Permitted Intrusion at Shoulder Height Transversal Section of the Minimum Available Space at Shoulder Height for a Seat Adjacent to the Wall of the Bus

3.2.8.	Buses fitted with a priority seat shall have pictogram(s) (See Fig.6 to this Annexure). visible from the outside, both on the front nearside of the bus and adjacent to the relevant service door(s). A pictogram shall be placed internally adjacent to the priority seat.
	
	Colour: blue basis with white symbol Size: at least 130 mm diameter
	Reference for the design principles of safety symbols: ISO 3864-1:2002
	Figure 6 **Pictogram for Passengers with Reduced Mobility other than Wheelchair Users**

3.3	**Communication Devices**
3.3.1	Communication devices shall be placed adjacent to any priority seat and within any wheelchair area and shall be at a height between 700 mm and 1,200 mm above the floor.
3.3.2	Communication devices situated in the low floor area shall be at a height between 800mm and 1,500mm where there are no seats.
3.3.3	(Reserved)
3.3.4	If a bus is fitted with a ramp or lift, a means of communication with the driver shall be fitted outside, adjacent to the door, and at a height between 850mm and 1,300mm from the ground. This requirement shall not apply to a door situated in the direct field of vision of the driver.
3.4	**Handrails to Priority Seating**
3.4.1	A handrail at a height of between 800mm and 900mm above the floor level shall be provided between the priority seats as described in Paragraph 3.4.1.1 and at least one service door suitable for boarding and alighting. A break is permitted where it is necessary to gain access to a wheelchair space, a seat located at a wheel arch, a staircase, an access passage or a gangway. Any break in the handrail shall not exceed 1,050mm and a vertical handrail shall be provided on at least one side of the break.
3.4.1.1	The minimum number of priority seats complying with the requirements of paragraph shall be as per AIS:216

3.4.2	Handrails or handholds shall be placed adjacent to priority seating positions to facilitate entry and exit of the seat, and shall be designed in such a way as to allow the passenger to grasp them easily.
3.5	**Floor Slope**
	The slope of any gangway, access passage or floor area between any priority seat or wheelchair space and at least one entrance and one exit or a combined entrance and exit shall not exceed 8%. Such sloping areas shall be provided with a slip-resistant surface.
3.6	**Wheelchair Accommodation Provisions**
3.6.1	For each wheelchair user provided for in the passenger compartment there shall be a special area at least 750 mm wide and 1,300 mm long. The longitudinal plane of the special area shall be parallel to the longitudinal plane of the bus and the floor surface of the special area shall be slip resistant and the maximum slope in any direction shall not exceed 5%. In the case of a rearward facing wheelchair complying with the requirements specified in Paragraph 3.8.4 of this Annexure, the slope in the longitudinal direction shall not exceed 8% provided that this slope inclines upwards from the front end to the rear end of the special area.
	In the case of a wheelchair space designed for a forward facing wheelchair, the top of preceding seat-backs may intrude into the wheelchair space if a clear space is provided (See Fig.7 to this Annexure). However, wheelchair accommodation provisions shall not be applicable for buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons and/or buses with overall length less than 7 meters
	
	Figure 7 **Minimum Clear Space for the Wheelchair User at the Wheelchair Space**

3.6.2	There shall be at least one doorway through which wheelchair users can pass. In the case of buses of Type I, at least one wheelchair access door shall be a service door. The wheelchair access door shall bear a boarding device complying with the provisions of Paragraph 3.11.3. (a lift) or 3.11.4. (a ramp) of this Annexure. For buses with floor height upto 900 mm the boarding device shall be a lift or ramp. However, for buses with floor height above 900 mm the boarding device shall be a lift. For buses deployed on BRTS (Bus Rapid Transit System) routes where level boarding is available, boarding devices viz., ramp and lift are not required.
3.6.3	A door for wheelchair access, that is not a service door, shall have a minimum height of 1,400 mm. The minimum width of all doors providing wheelchair access to the bus shall be 900 mm which may be reduced by 100 mm when the measurement is made at the level of handholds.
3.6.4	It shall be possible for a wheelchair user to move freely and easily from the outside of the bus through at least one of the doors for wheelchair access into the special area(s) with a reference wheelchair, the dimensions of which are shown. (See Fig. 8 to this Annexure).
	
	Note:
	A wheelchair user seated in the wheelchair adds 50mm to the overall length and makes a height of 1,350mm above the ground
	Figure 8 **Reference Wheelchair**
3.6.4.1	By "moving freely and easily", it is meant that there exists:
3.6.4.1.1	Sufficient space available for the wheelchair user to manoeuvre without the assistance of a person;
3.6.4.1.2	There are no steps, gaps or stanchions which could be an obstacle to the free movement of the wheelchair user.
3.6.4.2	For the application of the above provisions, the test shall be performed, in the case of buses of Type I fitted with more than one wheelchair space, for each wheelchair space with all other wheelchair spaces occupied by the

	reference wheelchair.
3.6.5	In buses of Type I fitted with a ramp for wheelchair access, it shall be possible for a reference wheelchair having the dimensions shown (See Fig.9 to this Annexure) to enter and exit a bus with the wheelchair moving in a forward direction.
3.6.6	Buses fitted with a wheelchair space shall have pictogram(s) in accordance with Figure (See Fig.9 to this Annexure) visible from the outside, both on the front nearside of the bus and adjacent to the relevant service door(s).
	
	Figure 9 **Pictogram for Wheelchair Users**
	One of these pictograms shall be placed internally adjacent to each wheelchair space indicating whether the wheelchair is to be positioned facing the front or the rear of the bus.
	Colour: blue basis with white symbol Size: at least 130 mm diameter
	Reference for the design principles of safety symbols: ISO 3864-1:2002
3.7	**Seats and Standing Passengers in the Wheelchair Space**
3.7.1	Folding seats may be fitted in a wheelchair space. However, such seats when folded and out of use shall not intrude into the wheelchair space.
3.7.2	A bus may be equipped with demountable seats fitted in the wheelchair space provided that such seats may be easily removed by the driver or a crew member.
3.7.3	For buses, where the foot space of any seat, or part of a folding seat when in use, intrudes into a wheelchair space, those seats shall have signs fixed on or adjacent to them with the following text, equivalent text or pictogram;
	Please give up this space for a wheelchair user

	The provisions of paragraph 3.7.4.1 og this Annexure shall apply to any textual markings used.
3.7.4	In buses where any wheelchair space is designated for use exclusively by a wheelchair user as provided for the surface of any wheelchair space(s) dedicated solely for the use of wheelchair user(s), those spaces shall be clearly marked with the following text, equivalent text or pictogram:
	"Area designated for use exclusively by a wheelchair user" The provisions of Paragraph 3.7.4.1 of this Annexure shall apply to any textual markings used.
3.7.4.1	Safety Signs
3.7.4.1.1	All safety signs shall meet requirements as specified in clause 3.4.5.5 of this standard.
3.8	**Stability of Wheelchairs**
3.8.1	In buses required to have occupant restraint systems fitted, the wheelchair space shall be designed for the wheelchair user to travel facing forwards and shall be fitted with restraint systems complying with either the requirements specified in Paragraph 3.8.2. or those specified in Paragraph 3.8.3. below
	In buses not required to have occupant restraint systems fitted, the wheelchair space shall be fitted with restraint systems complying with the requirements specified in Paragraph 3.8.2 or 3.8.3., or shall comply with the requirements specified in Paragraph 3.8.4. below.
3.8.2	Forward-facing Wheelchair – Static Test Requirements
3.8.2.1	Each wheelchair space shall be provided with a restraint system capable of restraining the wheelchair and the wheelchair user.
3.8.2.2	This restraint system and its anchorages shall be designed to withstand forces equivalent to the ones required for the passenger seats and occupant restraint systems.
3.8.2.3	A static test shall be carried out in accordance with the following requirements:
3.8.2.3.1	The forces referred hereto shall be applied in forward and rearward directions, separately and on the restraint system itself;
3.8.2.3.2	The force shall be maintained for a period of not less than 0.2 s;
3.8.2.3.3	The restraint system shall be capable of withstanding the test. Permanent deformation, including partial rupture or breakage of the restraint system shall not constitute failure if the required force is sustained for the specified time. Where applicable, the locking device enabling the wheelchair to leave the bus shall be operable by hand after removal of the traction force.

3.8.2.4	In forward direction in the case of a separate wheelchair and wheelchair user restraint system
3.8.2.4.1	**For Category M2:**
3.8.2.4.1.1	1,110daN ± 20daN in the case of a lap belt. The force shall be applied on the wheelchair user restraint system in the horizontal plane of the bus and towards the front of the bus if the restraint system is not attached to the floor of the bus. If the restraint system is attached to the floor, the force shall be applied in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus;
3.8.2.4.1.2	675 daN ± 20 daN in the horizontal plane of the bus and towards the front of the bus on the lap portion of the belt and 675daN ± 20daN in the horizontal plane of the bus and towards the front of the bus on the torso portion of the belt in the case of 3-point belt;
3.8.2.4.1.3	1,715 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the wheelchair restraint system;
3.8.2.4.1.4	The forces shall be applied simultaneously.
3.8.2.4.2	**For Category M3:**
3.8.2.4.2.1	740 daN ± 20 daN in the case of a lap belt. The force shall be applied on the wheelchair user restraint system in the horizontal plane of the bus and towards the front of the bus if the restraint system is not attached to the floor of the bus. If the restraint system is attached to the floor, the force shall be applied in an angle 45° ± 10° to the horizontal plane of the bus and towards the front of the bus;
3.8.2.4.2.2	450 daN ± 20 daN in the horizontal plane of the bus and towards the front of the bus on the lap portion of the belt and 450 daN ± 20 daN in the horizontal plane of the bus and towards the front of the bus on the torso portion of the belt in the case of 3-point belt;
3.8.2.4.2.3	1,130 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the wheelchair restraint system;
3.8.2.4.2.4	The forces shall be applied simultaneously.
3.8.2.5	In forward direction in the case of a combined wheelchair and wheelchair user restraint system.
3.8.2.5.1	**For Category M2;**
3.8.2.5.1.1	1,110 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the wheelchair user restraint system in the case of a lap belt;
3.8.2.5.1.2	675 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the lap portion of the belt and 675 daN ± 20 daN in the horizontal plane of the bus and towards the front of the bus on

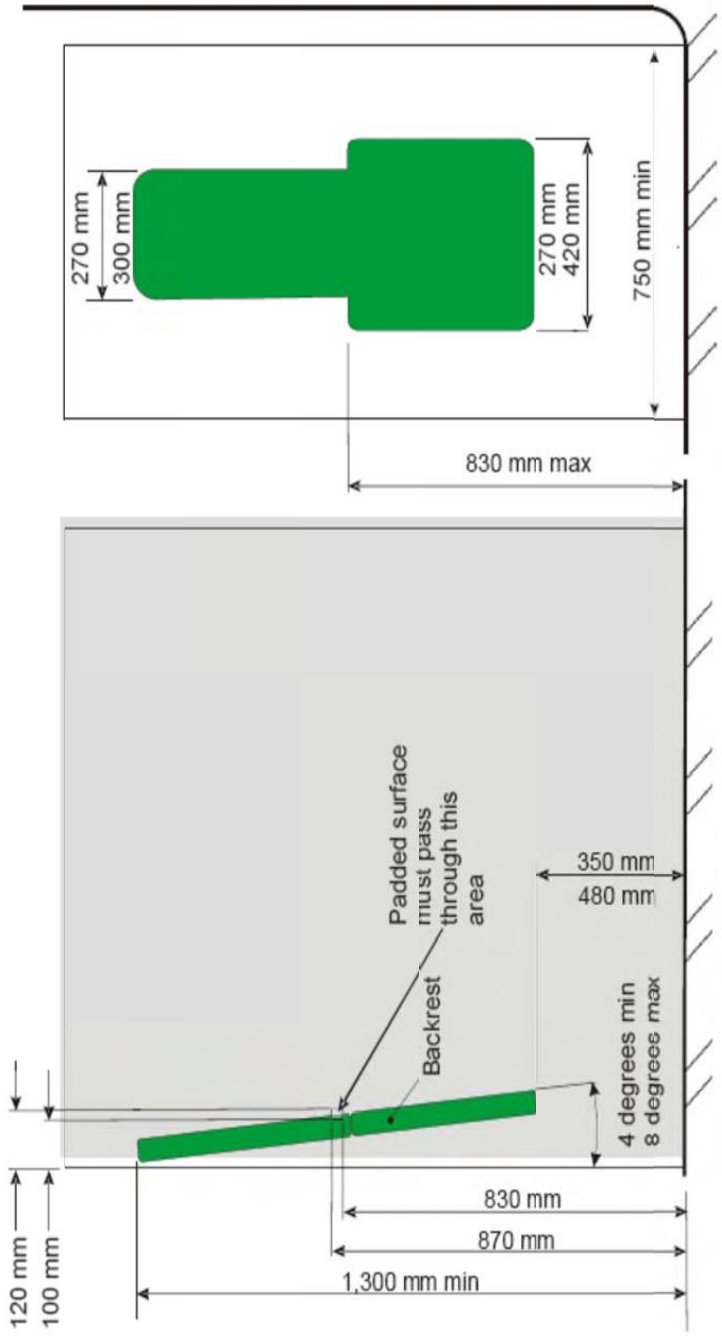
	the torso portion of the belt in the case of 3-point belt;
3.8.2.5.1.3	1,715 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the wheelchair restraint system;
3.8.2.5.1.4	The forces shall be applied simultaneously.
3.8.2.5.2	For Category M3:
3.8.2.5.2.1	740 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the wheelchair user restraint system in the case of a lap belt;
3.8.2.5.2.2	450 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the lap portion of the belt and 450 daN ± 20 daN in the horizontal plane of the bus and towards the front of the bus on the torso portion of the belt in the case of 3-point belt;
3.8.2.5.2.3	1,130 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the front of the bus on the wheelchair restraint system;
3.8.2.5.2.4	The forces shall be applied simultaneously.
3.8.2.6	In rearward direction:
3.8.2.6.1	810 daN ± 20 daN in an angle of 45° ± 10° to the horizontal plane of the bus and towards the rear of the bus on the wheelchair restraint system.
3.8.2.7	In every case the forces shall be applied to the wheelchair user restraint system by means of a traction device appropriate to the belt type as specified in IS 15139-2002;.
3.8.3	Forward-facing Wheelchair – Hybrid Test Requirements
3.8.3.1	A wheelchair space shall be fitted with a wheelchair restraint system suitable for general wheelchair application and shall allow the carriage of a wheelchair and a wheelchair user facing the front of the bus;
3.8.3.2	A wheelchair space shall be fitted with a wheelchair user restraint system which shall comprise of a minimum of two anchorage points and a pelvic restraint (lap belt) designed and constructed of components intended to perform in a similar manner to those of a seat belt conforming to IS 15140-2003;
3.8.3.3	Any restraint system fitted to a wheelchair space shall be capable of being easily released in the case of an emergency;
3.8.3.4	Any wheelchair restraint system shall either:
3.8.3.4.1	Meet the dynamic test requirements described in Paragraph 3.8.3.8. and be securely attached to bus anchorages meeting the static test requirements in Paragraph 3.8.3.6. below; or
3.8.3.4.2	Be securely attached to bus anchorages such that the combination of

	restraint and anchorages meets the requirements of Paragraph 3.8.3.8.
3.8.3.5	Any wheelchair user restraint shall either:
3.8.3.5.1	Meet the dynamic test requirements described in Paragraph 3.8.3.9. and be securely attached to bus anchorages meeting the static test requirements in Paragraph 3.8.3.6. below; or
3.8.3.5.2	Be securely attached to bus anchorages such that the combination of restraint and anchorages meets the dynamic test requirements described in Paragraph 3.8.3.9. when attached to anchorages set up as described in Paragraph 3.8.3.6.7.
3.8.3.6	A static test shall be carried out on the anchorage points for both the wheelchair restraint system and the wheelchair user restraint in accordance with the following requirements:
3.8.3.6.1	The forces specified in Paragraph 3.8.3.7. below shall be applied by means of a device reproducing the geometry of the wheelchair restraint system;
3.8.3.6.2	The forces specified in Paragraph 3.8.3.7.3. below shall be applied by means of a device reproducing the geometry of the wheelchair user restraint and by means of a traction device specified in IS 15139-2002;.
3.8.3.6.3	The forces in Paragraph 3.8.3.6.1. above and Paragraph 3.8.3.6.2. shall be applied simultaneously in the forward direction and at an angle of 10° ± 5° above the horizontal plane;
3.8.3.6.4	The forces in Paragraph 3.8.3.6.1. above shall be applied in the rearward direction and at an angle of 10° ± 5° above the horizontal plane;
3.8.3.6.5	The forces shall be applied as rapidly as possible through the central vertical axis of the wheelchair space; and
3.8.3.6.6	The force shall be maintained for a period of not less than 0.2s.
3.8.3.6.7	The test shall be carried out on a representative section of the bus structure together with any fitting provided in the bus which is likely to contribute to the strength or rigidity of the structure.
3.8.3.7	The forces specified in Paragraph 3.8.3.6. above are:
3.8.3.7.1	In the case of anchorages provided for a wheelchair restraint system fitted to a Category M2 bus:
3.8.3.7.1.1	1,110 daN ± 20 daN applied in the longitudinal plane of the bus and towards the front of the bus at a height of not less than 200mm and not more than 300 mm measured vertically from the floor of the wheelchair space, and
3.8.3.7.1.2	550 daN ± 20 daN applied in the longitudinal plane of the bus and towards the rear of the bus at a height of not less than 200 mm and not more than

	300mm measured vertically from the floor of the wheelchair space;
3.8.3.7.2	In the case of anchorages provided for a wheelchair restraint system fitted to a Category M3 bus.
3.8.3.7.2.1	740 daN ± 20 daN applied in the longitudinal plane of the bus and towards the front of the bus at a height of not less than 200 mm and not more than 300mm measured vertically from the floor of the wheelchair space, and
3.8.3.7.2	370 daN ± 20 daN applied in the longitudinal plane of the bus and towards the rear of the bus at a height of not less than 200 mm and not more than 300 mm measured vertically from the floor of the wheelchair space;
3.8.3.7.3	In the case of anchorages provided for a wheelchair user restraint system the forces shall be in accordance with the requirements of IS 15139-2002; The forces shall be applied by means of a traction device as appropriate to the belt type as specified in IS 15139-2002;
3.8.3.8	A wheelchair restraint system shall be subject to a dynamic test carried out in accordance with the following requirements:
3.8.3.8.1	A representative wheelchair test trolley of mass 85 kg shall, from a speed of between 48 km/h to 50 km/h to rest, be subject to a deceleration-time pulse:
3.8.3.8.1.1	Exceeding 20 g in the forward direction for a cumulative period of at least 0.015 s;
3.8.3.8.1.2	Exceeding 15 g in the forward direction for a cumulative period of at least 0.04 s;
3.8.3.8.1.3	Exceeding a duration of 0.075 s;
3.8.3.8.1.4	Not exceeding 28 g and for not more than 0.08 s;
3.8.3.8.1.5	Not exceeding a duration of more than 0.12 s, and
3.8.3.8.2	A representative wheelchair test trolley of mass 85 kg shall, from a speed of between 48 km/h to 50 km/h to rest, be subject to a deceleration-time pulse:
3.8.3.8.2.1	Exceeding 5 g in the rearward direction for a cumulative period of at least 0.015 s;
3.8.3.8.2.2	Not exceeding 8g in the rearward direction and for not more than 0.02 s;
3.8.3.8.3	The test in Paragraph 3.8.3.8.2. above shall not apply if the same restraints are used for the forward and rearward direction or if an equivalent test has been conducted;
3.8.3.8.4	For the above test, the wheelchair restraint system shall be attached to

	either:
3.8.3.8.4.1	Anchorages fixed to the test rig which represents the geometry of the anchorages in a bus for which the restraint system is intended, or
3.8.3.8.4.2	Anchorages forming part of a representative section of the bus for which the restraint system is intended, set up as described in Paragraph 3.8.3.6.7. above.
3.8.3.9	A wheelchair user restraint shall comply with the test requirements specified in IS 15140-2003; or an equivalent test to the deceleration-time pulse in Paragraph 3.8.3.8.1. above. A seat belt approved to IS 15140-2003; and so marked shall be deemed to comply.
3.8.3.10	A test in Paragraph 3.8.3.6., 3.8.3.8. or 3.8.3.9. above shall be deemed to have failed unless the following requirements are met:
3.8.3.10.1	No part of the system shall have failed, or shall have become detached from its anchorage or from the bus during the test;
3.8.3.10.2	Mechanisms to release the wheelchair and user shall be capable of release after completion of the test;
3.8.3.10.3	In the test in Paragraph 3.8.3.8. above the wheelchair shall not move more than 200mm in the longitudinal plane of the bus during the test;
3.8.3.10.4	No part of the system shall be deformed to such an extent after completion of the test that, because of sharp edges or other protrusions, the part is capable of causing injury.
3.8.3.11	Its operating instructions shall be clearly displayed adjacent to it.
3.8.4	Rearward-facing Wheelchair – Static Test requirements
3.8.4.1	Buses not required to have occupant restraint systems fitted may, as an alternative to the provisions of Paragraph 3.8.2 or 3.8.3. above, be provided with a wheelchair space designed for the wheelchair user to travel unrestrained with the wheelchair facing rearwards against a support or backrest, in accordance with the following provisions:
3.8.4.1.1	One of the longitudinal sides of the space for a wheelchair shall rest against a side or wall of the bus or a partition;
3.8.4.1.2	A support or backrest perpendicular to the longitudinal axis of the bus shall be provided in the forward end of the wheelchair space;
3.8.4.1.3	The support or backrest shall be designed for the wheels or the back of the wheelchair to rest against the support or backrest in order to avoid the wheelchair from tipping over and shall comply with the provisions of Paragraph 3.8.5. below;

3.8.4.1.4	A handrail or handhold shall be fitted to the side or wall of the bus or a partition in such a way to allow the wheelchair user to grasp it easily. This handrail shall not extend over the vertical projection of the wheelchair space, except by not more than 90mm and only at a height not less than 850mm above the floor of the wheelchair space;
3.8.4.1.5	A retractable handrail or any equivalent rigid device shall be fitted on the opposite side of the wheelchair space in order to restrict any lateral shift of the wheelchair and to allow the wheelchair user to grasp it easily;
3.8.4.1.6	A sign shall be fixed adjacent to the wheelchair area with the following text: "This space is reserved for a wheelchair. The wheelchair shall be placed facing rearwards resting against the support or backrest with the brakes on" The provisions of Paragraph 3.7.4.1 apply to any textual markings used.
3.8.5	**Backrest and Support Requirements**
3.8.5.1	A backrest fitted to a wheelchair space in accordance with Paragraph 3.8.4. shall be fitted perpendicular to the longitudinal axis of the bus and shall be capable of bearing a load of 250 ± 20daN applied to the centre of the padded surface of the backrest, at a height of not less than 600mm and of not more than 800mm measured vertically from the floor of the wheelchair space, for a minimum of 1.5s by means of a block 200mm X 200mm in the horizontal plane of the bus towards the front of the bus. The backrest shall not deflect more than 100mm or suffer permanent deformation or damage.
3.8.5.2	A support fitted to a wheelchair space in accordance with Paragraph 3.8.4. shall be fitted perpendicular to the longitudinal axis of the bus and shall be capable of withstanding a force of 250daN ± 20daN applied to the centre of the support, for a minimum of 1.5s in the horizontal plane of the bus towards the front of the bus in the middle of the support. The support shall not deflect more than 100mm or suffer permanent deformation or damage.
3.8.6	Example of a backrest meeting the requirements of Paragraph 3.8.4.1.3. above (See Fig.10 to this Annexure).

	
	Figure 10 **Example of a Backrest for a Rearward-facing Wheelchair**
3.8.6.1	The bottom edge of a backrest shall be at a height of not less than 350mm and of not more than 480mm measured vertically from the floor of the wheelchair space.
3.8.6.2	The top edge of a backrest shall be at a height of not less than 1,300mm measured vertically from the floor of the wheelchairspace.

3.8.6.3	A backrest shall have a width of:
3.8.6.3.1	Not less than 270mm and of not more than 420mm up to a height of 830mm measured vertically from the floor of the wheelchair space, and
3.8.6.3.2	Not less than 270mm and of not more than 300mm at heights exceeding 830mm measured vertically from the floor of the wheelchair space.
3.8.6.4	A backrest shall be fitted at an angle of not less than 4 degree and of not more than 8 degree to the vertical with the bottom edge of the backrest positioned closer to the rear of the bus than the top edge.
3.8.6.5	The padded surface of a backrest shall form a single and continuous plane.
3.8.6.6	The padded surface of a backrest shall pass through any point on an imaginary vertical plane situated to the rear of the front end of the wheelchair space and situated not less than 100mm and not more than 120mm from the front end of the wheelchair space measured horizontally and not less than 830mm and not more than 870mm from the floor of the wheelchair space measured vertically.
3.9	**Door Controls**
3.9.1	If a door referred to in Paragraph 3.6 is fitted with opening controls for use under normal circumstances, these controls shall:
3.9.1.1	In the case of exterior controls, be on or adjacent to that door at a height between 850mm and 1,300mm from the ground and be not more than 900mm from the door, and
3.9.1.2	In the case of interior controls in buses of Type I, ~~II and III,~~ be on or adjacent to that door at a height of between 850mm and 1,300mm from the upper surface of the floor nearest the control and be not more than 900mm in any direction from the door aperture.
3.10	Provisions for the Accommodation of Unfolded Prams and Pushchairs, if provided.
3.10.1	(Reserved)
3.10.2	The dimensions of the unfolded pram or pushchair area shall not be less than 750mm wide and 1,300mm long. Its longitudinal plane shall be parallel to the longitudinal plane of the bus and the floor surface shall be slip resistant.
3.10.3	Accessibility to prams and pushchairs areas shall be provided in accordance with the following provisions:
3.10.3.1	It shall be possible for an unfolded pram or pushchair to be moved freely and easily from the outside of the bus through at least one of the service doors into the special area(s)

3.10.3.1.1	By "moving freely and easily", it is meant that:
	(a) There is sufficient space available for the pram or pushchair to be manoeuvred; (b) There are no steps, gaps or stanchions which could be an obstacle to the free movement of the pram or pushchair.
3.10.4	The area shall be fitted with the pictogram (See Fig.11 to this Annexure).

	 For each Prams and Pushchairs
	Colour: blue basis with white symbol Size: at least 130mm diameter
	Reference for the design principles of safety symbols: ISO 3864-1:2011
	Figure 11 **Pictogram for Pram and pushchair Area**
3.10.4.1	The same pictogram shall be placed both on the front nearside of the bus and adjacent to the service door that gives access to the pram or pushchair area.
3.10.5	The following requirements shall apply to the stability of the unfolded pram or pushchair:
3.10.5.1	One of the longitudinal sides of the space for a pram or pushchair shall rest against a side or wall of the bus or a partition;
3.10.5.2	A support or backrest perpendicular to the longitudinal axis of the bus shall be provided in the forward end of the pram or pushchair space;
3.10.2.3	The support or backrest shall be designed to avoid the pram or pushchair from tipping over and shall comply with the provisions of Paragraph 3.8.5. above;
3.10.2.4	A handrail or handhold shall be fitted to the side or wall of the bus or a partition in such a way to allow the accompanying person to grasp it easily. This handrail shall not extend over the vertical projection of the pram or

	pushchair space, except by not more than 90mm and only at a height not less than 850mm above the floor of the pram or pushchair space;
3.10.5.5	A retractable handrail or any equivalent rigid device shall be fitted on the opposite side of the pram or pushchair space in order to restrict any lateral shift of the pram or pushchair.
3.10.6	The area shall be provided with a specific control, e.g. a push-button, to enable the passenger with an unfolded pram or pushchair to request that the bus be stopped at the next bus stop. The general requirements of Paragraph 3.10.6.1 shall apply.
3.10.6.1	On buses of Type I, a means shall be provided to enable passengers to signal that the driver should stop the bus. The controls for all such communication devices shall be capable of being operated with the palm of the hand. There shall be appropriate communication devices distributed adequately and evenly throughout the bus and no more than 1,500mm from the floor, this does not exclude the possibility of installing higher additional communication devices. Controls shall contrast visually with their immediate surroundings. Activation of the control shall also be indicated to the passengers by means of one or more illuminated signs. The sign shall display the words "bus stopping" or equivalent, and/or a suitable pictogram and shall remain illuminated until the service door(s) open. Articulated buses shall have such signs in each rigid section of the bus. The provisions of Paragraph 3.7.4.1 apply to any textual markings used.
3.10.7	The control shall be fitted with the pictogram described (See Fig.12 to this Annexure).. The dimensions of the pictogram may be reduced as needed.
3.10.8	The area to accommodate the unfolded pram or pushchair may adjoin the area for the wheelchair and be in its extension. Intrusions of stanchions to provide handholds for standing passengers may be permitted provided the requirement of Paragraph 3.10.3. of this Annexure is met.
3.10.9	Additional wheelchair areas may be combined with the area for the accommodation of an unfolded pram or pushchair provided the relevant requirements are met. In such a case, the area shall have signs fixed on or adjacent to them with the following text, equivalent text or pictogram:
	"Please give up this space for a wheelchair user".
3.11	**Provisions for Boarding Devices**
3.11.1	General requirements:
3.11.1.1	The controls actuating the boarding devices shall be clearly marked as such. The extended or lowered position of the boarding device shall be indicated by a tell-tale to the driver.
3.11.1.2	In the event of the failure of a safety device, lifts, ramps and kneeling systems shall be incapable of operation, unless they can be safely operated by manual

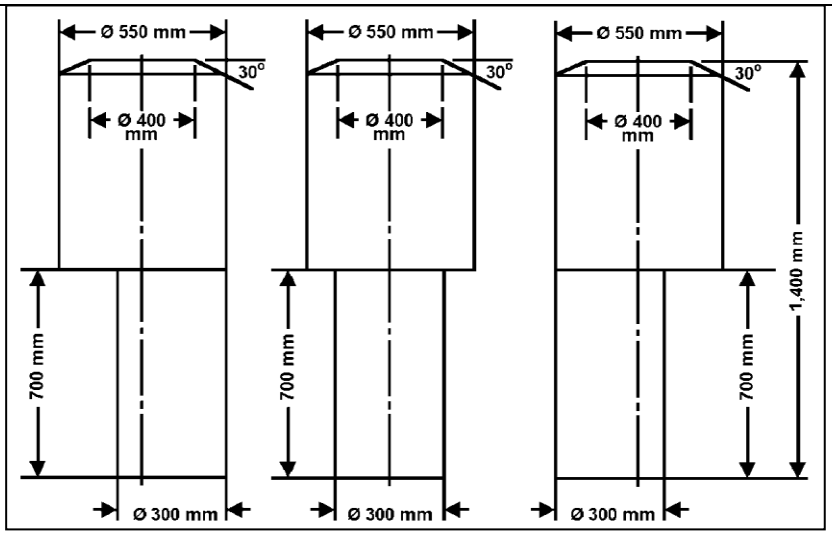
	effort. The type and location of the emergency operating mechanism shall be clearly marked. In the event of power failure, lifts and ramps shall be capable of manual operation.
3.11.1.3	Access to one of the service or emergency doors on the bus may be obstructed by a boarding device providing the following two conditions are satisfied from both inside and outside the bus.
3.11.1.3.1	The boarding device does not obstruct the handle or other device for opening the door.
3.11.1.3.2	The boarding device can be readily moved to leave the doorway clear for use in an emergency.
3.11.2	**Kneeling System**
	All Low floor buses with 400 mm floor height and with Air suspension shall meet requirements of kneeling system. Kneeling height shall be 60 mm at the entry/exit level. Buses with 401-650 mm floor height may be provided with ramp.
3.11.2.1	Unless otherwise stated, all measurements shall be made when the bus is at its unladen weight and it is standing on a smooth and horizontal ground surface and in the normal condition for travel. If a kneeling system is fitted, it shall be set so the buses at its normal ride height for travel. In the case of approval of bodywork as a separate technical unit, the position of the body relative to the flat horizontal surface shall be specified by the manufacturer.
3.11.2.2	Wherever there is a requirement in this Standard for a surface in the bus to be horizontal or at a specific angle when the bus is at its unladen weight, in the case of a bus with mechanical suspension, the surface may exceed this slope or possess a slope when the bus is in unladen weight, provided that this requirement is met when the bus is in the loading condition declared by the manufacturer. If a kneeling system is fitted to the bus, it shall not be in operation.
3.11.2.3	In buses either a kneeling system and/or a retractable step may be engaged.
3.11.2.4	In the event of the failure of a safety device, lifts, ramps and kneeling systems shall be incapable of operation, unless they can be safely operated by manual effort. The type and location of the emergency operating mechanism shall be clearly marked. In the event of power failure, lifts and ramps shall be capable of manual operation.
3.11.2.5	A switch shall be required to enable operation of the kneeling system.

3.11.2.6	Any control which initiates the lowering or raising of any part or the whole of the bodywork relative to the road surface shall be clearly identified and be under the direct control of the driver.
3.11.2.7	The lowering process shall be capable of being stopped and immediately reversed by a control both within the reach of the driver, whilst seated in the cab, and also adjacent to any other operating controls provided for the operation of the kneeling system.
3.11.2.8	Any kneeling system that is fitted to a bus shall not allow the bus to be driven at a speed of more than 5km/h when the bus is lower than the normal height of travel.
3.11.3	**Lift**
3.11.3.1	**General Provisions**
3.11.3.1.1	Lifts shall only be capable of operation when the bus is at standstill. Any movement of the platform shall be prevented unless a device preventing the wheelchair from rolling off has been activated or has automatically come into operation.
3.11.3.1.2	The lift platform shall not be less than 800mm wide, and not less than 1,200mm long and shall be capable of operating when carrying a mass of at least 300kg.
3.11.3.2	Additional technical requirements for power-operated lifts
3.11.3.2.1	The operating control shall be designed in such a way that, if released, it automatically returns to the off position. As it does so the movement of the lift shall immediately be stopped and it shall be possible to initiate a movement in either direction.
3.11.3.2.2	A safety device (e.g. reversing mechanism) shall protect areas not visible to the operator, where the movement of the lift might trap or crush objects.
3.11.3.2.3	In the event of one of these safety devices coming into operation, the movement of the lift shall immediately be stopped and movement in the opposite direction initiated.
3.11.3.3	Operation of power operated lifts
3.11.3.3.1	Where the lift is at a service door situated within the direct field of vision of the driver of the bus, the lift may be operated by the driver when in the driver's seat.
3.11.3.3.2	In all others cases, the controls shall be adjacent to the lift. They shall be capable of being activated and deactivated only by the driver from his seat.

3.11.3.4	Manually operated lift
3.11.3.4.1	The lift shall be designed for operation by controls adjacent to the lift.
3.11.3.4.2	The lift shall be so designed that excessive forces are not required to operate it.
3.11.4	**Ramp**
3.11.4.1	**General Provisions**
3.11.4.1.1	The ramp shall only be capable of operation when the bus is at standstill.
3.11.4.1.2	Edges on the outside shall be rounded to a radius of no less than 2.5mm. Corners on the outside shall be rounded to a radius of not less than 5mm.
3.11.4.1.3	The useable surface of a ramp shall be at least 800mm wide. In case of buses with floor height upto 650 mm, the slope of the ramp, when extended or folded out on to a kerb of 150 mm in height, should not exceed 25% (14 degrees). The slope of the ramp, when extended or folded out to the ground, should not exceed 60% (31 degrees). A kneeling system may be used to achieve this test. [In case of buses with floor height more than 650 mm and upto 900 mm, the slope of the ramp,when extended or folded out to the ground, should not exceed 49%(26 degrees).] To be discussed in Panel meeting.
3.11.4.1.4	Any ramp which when ready for use exceeds 1,200mm in length shall be fitted with a device to prevent the wheelchair rolling off the sides.
3.11.4.1.5	Any ramp shall be capable of operating safely with a load of 300kg.
3.11.4.1.6	The outer edge of ramp surfaces available for use by a wheelchair shall be clearly marked with a band of colour 45mm to 55mm in width which contrasts visually with the remainder of the ramp surface. The band of colour shall extend along the outermost edge and along both edges parallel to the direction of travel of the wheelchair. Marking of any trip hazard or where part of the ramp surface also forms part of the step is permissible.
3.11.4.1.7	A portable ramp shall be secure when in its position for use. A portable ramp shall be provided with a suitable position where it can be safely stowed and where it is readily available for use.
3.11.4.2	**Modes of Operation**
3.11.4.2.1	Deployment and stowage of the ramp may be either manually or power-

	operated.
3.11.4.3	Additional Technical Requirements for Power-operated Ramps
3.11.4.3.1	Deployment and stowage of the ramp shall be indicated by flashing yellow lights and an audible signal.
3.11.4.3.2	Deployment and stowage of the ramp that may create a risk of injury shall be protected by a safety device(s).
3.11.4.3.3	These safety devices shall stop the movement of the ramp when the ramp is subject to a reactive force not exceeding 150N. The peak force may be higher than 150N for a short time provided that it does not exceed 300N. The reactive force may be measured by any method to the satisfaction of the Type Approval Authority. Guidelines for measuring the reactive forces are given in Appendix VI to this Standard.
3.11.4.3.4	The horizontal movement of a ramp shall be interrupted when a mass of 15kg is placed upon it.
3.11.4.4	Operation of power-operated ramps
3.11.4.4.1	Where the driver has an adequate view of the ramp sufficient to monitor its deployment and use, to ensure the safety of passengers, the ramp may be operated by the driver when in the driver's seat. This requirement may be met by a suitable indirect vision device(s).
3.11.4.4.2	In all others cases, the controls shall be adjacent to the ramp. They shall be capable of being activated and deactivated only by the driver from his seat.
3.11.4.5	Operation of manually-operated ramp
3.11.4.5.1	The ramp shall be so designed that excessive forces are not required to operate the ramp.
3.11.4.5.2	Reserved
3.11.5	**Escape Hatches:**
3.11.5.1	Buses shall be fitted with escape hatches, additional to the emergency doors and windows. The requirement for escape hatches shall be optional for buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons.
3.11.5.2	Escape hatches shall have an aperture with a minimum area as specified in clause number 2.2.4.16.2 of this standard.

3.11.5.3	Except as provided in Paragraph 2.11.4 hatches may also be fitted in the case of Type I buses.
3.11.5.4	Hatches shall not be fitted where technical components are installed which prese possible dangers to passengers using the escape hatches (e.g. high voltage systems, systems containing dangerous liquids and/or gas, etc.).
3.11.5.5	Required escape hatches shall be positioned as follows:-
	If there is only one hatch, it shall be situated in the middle third of the passenger compartment; or Note:- In case of buses accommodating CNG/LPG cylinders / Battery cooling system and AC units on the roof, escape hatch / es shall be positioned suitably.
	If there are two hatches, they shall be separated by a distance of at least 2 m measured between the nearest edges of the apertures in a line parallel to the longitudinal axis of the bus.
3.11.6	**Technical Requirements for Escape Hatches**
3.11.6.1	Every escape hatch shall operate so as not to obstruct the clear passage from insi or outside the bus.
3.11.6.2	Roof escape hatches shall be ejectable, hinged or made of readily-breakable safe glass. Floor hatches shall be either hinged or ejectable and shall be fitted with an audible warning device to warn the driver when it is not securely closed. The flo escape hatch lock, and not the movement of the hatch itself, shall actuate this dev Floor escape hatches shall be proofed against unintentional operation. However t requirement shall not apply if the floor hatch is locked automatically when the bu moving at a speed exceeding 5 km/h.
3.11.6.3	Ejectable types shall not become totally detached from the bus when operated su that the hatch is not a danger to other road users. The operation of ejectable escap hatches shall be such that inadvertent operation is effectively prevented. Floor ejectable hatches shall eject only into the passenger compartment.
3.11.6.4	Hinged escape hatches shall hinge along the edge towards the front or rear or sid the bus and shall hinge through an angle of at least 100 degrees. Hinged floor esc hatches shall into the passenger compartment.
3.11.6.5	Escape hatches shall be capable of being easily opened or removed from the inside and from the outside. However, this requirement shall not be construed as precluding the possibility of locking the escape hatch for the purpose of securing the bus when unattended, provided that the escape hatch can always be opened or removed from the inside by the use of the normal opening or removal mechanism. In the case of a readily-breakable hatch, a device shall be provided adjacent to the hatch, readily available to persons inside the bus, to ensure that the hatch can be broken.
3.11.7	**Access to Escape Hatches**
3.11.7.1	**Escape Hatches in the Roof**

3.11.7.1.1	Except in the case of Type I buses, at least one escape hatch shall be located such that a four-sided truncated pyramid having a side angle of 20 degree and a height of 1600 mmtouches part of a seat or equivalent support. The axis of the pyramid shall be vertical and its smaller section shall contact the aperture area of the escape hatch. Supports may be foldable or moveable provided they can be locked in their position of use. This position shall be taken for verification.
3.11.7.1.2	When the structural thickness of the roof is more than 150 mm, the smaller section of the pyramid shall contact the aperture area of the escape hatch at the level of the outside surface of the roof.
3.11.7.2	**Escape Hatches in the Floor**
3.11.7.2.1	In the case of an escape hatch fitted in the floor, the hatch shall give direct and free access to the exterior of the bus with openable of skirt panel and be fitted where there is a clear space above the hatch equivalent to the height of the gangway. Any heat source or moving components shall be at least 500 mm from any part of the hatch aperture.
3.11.7.2.2	It shall be possible to move a test gauge in the form of a thin plate having dimensions 600 mm X 400 mm with corners radi used by 200 mm in a horizontal position from a height above the floor of the bus of 1m to the ground.
3.11.8	**Access to Emergency Doors (See Fig. 1)** The following requirements shall not apply to Buses whose Gross Vehicle Weight (GVW) is less than 3.5 tons.
	 **Figure 1**

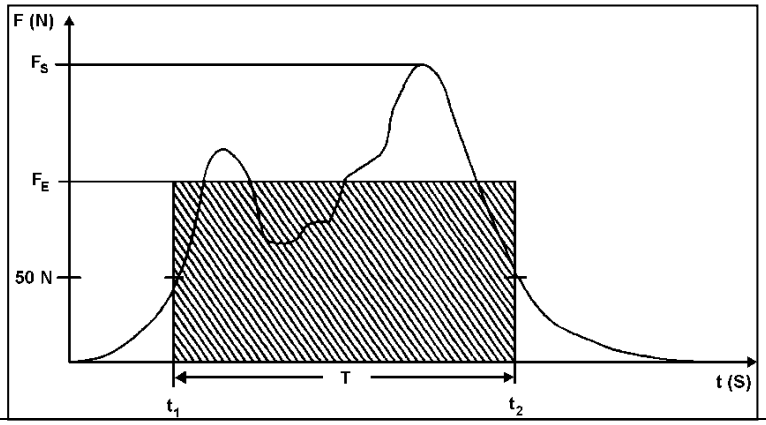
	Access to Emergency Doors
3.11.8.1	Except as provided for in Paragraph 3.11.8.4 below, the free space between the gangway and the emergency door aperture shall permit the free passage of a vertical cylinder 300 mm in diameter and 700 mm high from the floor and supporting a second vertical cylinder 550 mm in diameter, the aggregate height of the assembly being 1,400 mm. The diameter of the upper cylinder may be reduced at the top to 400 mm when a chamfer not exceeding 30° from the horizontal is included.
3.11.8.2	The base of the first cylinder shall be within the projection of the second cylinder.
3.11.8.3	Where folding seats are installed alongside this passage, the free space for the cylinder shall be required to be determined when the seat is in the position for use.
3.11.8.4	As an alternative to the dual cylinder, the gauging device described in Paragraph 2.2.8.1 of this standard may be used
3.11.9	**Prevention of Accidents:**
	If the engine compartment of a bus is located to the rear of the driver's compartment, it shall not be possible to start the engine from the driver's position when the main engine access panel located in the rear face of the bus is open and which provide direct access to parts that represent a hazard when the engine is running (e.g. pulley of belt drives).
3.11.10	**Trap Door, if fitted**
	Every trap door, that is not an escape hatch, on the floor of a bus shall be so fitted and secured that it cannot be dislodged or opened without the use of tools or keys Projection eight of all mounting screws for trap door other than gear box cover shall not exceed 8 mm.
3.11.11	The BRT (Bus Rapid Transit) buses having right side passenger door/s level boarding of wheelchair shall be deemed to meet the wheelchair related requirements of this standard.

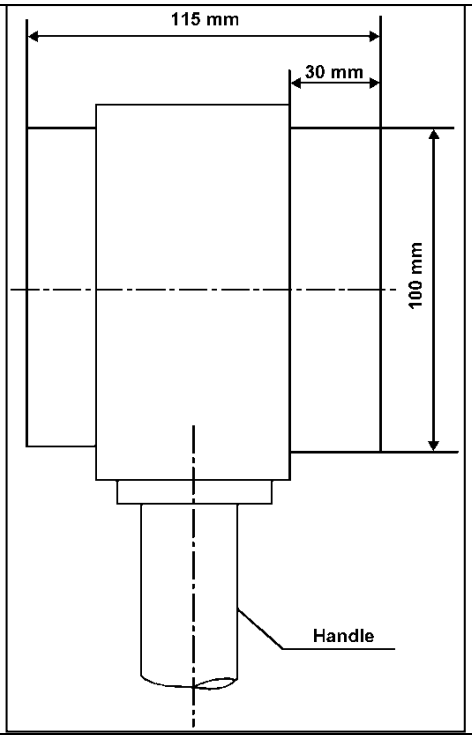
APPENDIX VI

(See Appendix V, Paragraph 3.11.4.3.3.)

THE REACTIVE FORCES OF POWER-OPERATED RAMPS

1.0	**GENERAL**
	The operation of a power-operated ramp is dynamic processes. When a moving ramp hits an obstacle, the result is a dynamic reaction force, the history of which (in time) depends on several factors (e.g. mass of the door or ramp, acceleration, dimensions).
2.0	**DEFINITIONS**
2.1	Closing or reactive force F(t) is a time function, measured at the outer edge of the ramp (see Paragraph 3.2. below).
2.2	Peak force F_S is the maximum value of the closing or reactive force.
2.3	Effective force F_E is the average value of the closing or reactive force related to the pulse duration:
	$$F_E = \frac{1}{T}\int_{t1}^{t2} F(t)dt$$
2.3.1	Pulse duration T is the time between the t_1 and t_2:
	$T = t_2 - t_1$
	Where, t_1 = threshold of sensitivity, where the closing or reactive force exceeds 50N. t_2 = fade-away threshold, where the closing or reactive force becomes less than 50N.
2.3.2	The relation between the above parameters is shown in Figure 1 below (as an example):

	
	Figure 1
2.3.3	Clamping or mean reactive force F_C is the arithmetical mean value of the effective forces, measured at the same measuring point subsequently more times:
	$$F_c = \frac{\sum_{i=1}^{i=n} (F_E)i}{n}$$
3.0	**MEASUREMENTS**
3.1	**Conditions of measurement:**
3.1.1	Temperature range: 10° - 30°C
3.1.2	The bus shall be standing on a horizontal surface. In the case of ramp measurements, this surface shall be fitted with a rigidly mounted block or other similar device having a face against which the ramp can react.
3.2	**Measurements points shall be:**
3.2.1	In the case of ramps:
3.2.1.1	At the outer edge of the ramp situated perpendicularly to its direction of movement: one in the middle of the ramp; one 100mm inboard from each of the edges parallel to the direction of travel of the ramp.
3.3	At least three measurements shall be taken at each of the measuring points to determine the clamping or mean reactive force according to Paragraph 2.6. above.
3.4	The signal of the closing or reactive force shall be recorded by means of a low-pass filter with a limiting frequency of 100Hz. Both the threshold of sensitivity and the fade-away threshold to limit the pulse duration shall be

	set at 50N.
3.5	The deviation of the reading from the rated value shall not be more than ± 3%.
4.0	**MEASURING DEVICE**
4.1	The measuring device shall consist of two parts: one handle and one measuring part which is a load cell (see Figure 2).
4.2	The load cell shall have the following characteristics:
4.2.1	It shall consist of two sliding housings with the outer dimension of 100mm in diameter and 115mm in width. Inside the load cell a compression spring shall be fitted between the two housings such that the load cell can be pressed together if an appropriate force is applied.
4.2.2	The stiffness of the load cell shall be 10 ± 0.2 N/mm. The maximum spring deflection shall be limited to 30mm so that a maximum peak force of 300N is achieved.
	
	Figure 2

APPENDIX VII ADDITIONAL TECHNICAL INFORMATION ON BUSES TO BE SUBMITTED BY BUS MANUFACTURER TO TESTING AGENCY			
	0.0	**Details of Bus manufacturer**	
	0.1	Name & address of the Bus manufacturer or importer	
	0.2	Telephone No.	
	0.3	Fax. No.	
	0.4	E-mail address	
	0.5	Contact person	
	0.6	Address of the Plant(s)of manufacture	
	0.7	Model Name	
	0.8	Variant Name	
	0.9	Vehicle Type (As per AIS- 216)	
	0.10	Seating Layout Drawing No.	
	0.11	Overall Vehicle Dimensions (mm)	
	0.11.1	Vehicle length, mm	
	0.11.2	Vehicle width, mm	
	0.11.3	Vehicle height, mm	
	0.12	Wheel Base (mm)	
	0.13	Seating Capacity	
	1.0	**Technical specification to be given to measure natural frequency**	
	1.1	Comfort Class (SDX/NDX/DLX/ACX)	
	1.2	Seat Type	
	1.3	Vehicle Kerb Mass (kg)	
	1.4	Gross Vehicle Mass (kg)	
	1.5	Floor Height from Ground (mm)	
	1.6	CG Location w.r.t. VCS (mm)	
	1.7	No. of Standees	
	1.8	Section Dimensions Details of Super-Structural Members	
	1.9	Material and Mechanical Properties of Super-Structural Members	

	1.10	LH Pillar Numbers	
	1.11	RH Pillar Numbers	
	1.12	Pillar Pitch	
	1.13	AC/NON-AC	
	1.14	Fuel Capacity and Tank Location	
	1.15	Total Mass of Fuel tank with structure	
	1.16	Tyre Size	
	1.16.1	Tyre Ply rating	
	1.16.2	Tyre Pressure in Unladen, PSI	
	1.17	Door Location	
	1.18	Number of service Doors	
	1.19	Total Mass of AC system with structure (If fitted)	
	1.19.1	AC system Location Roof Top FR/RR	
	1.20	Total Mass of Battery assembly system with structure	
	1.21	Battery system Location LH/RH/ FR/RR	
	1.22	Total Mass of Engine/ Motor, Transmission with structure	
	1.23	Engine/ Motor, Transmission Location FR/RR	

	2.0	**Technical specification for Noise, Vibration and harshness**	
	2.1	Gangway length, mm	
	2.2	Engine / Motor Type	
	2.3	Capacity, cc/ltr	
	2.4	Number of cylinders	
	2.5	Arrangement of cylinders	
	2.6	Type of Fuel (Diesel / Petrol /CNG / LPG / Hybrid / Electric/Ethanol etc.)	
	2.7	Rated Power, Kw	
	2.8	Rated Speed, rpm	
	2.9	Rated Torque, Nm	
	2.10	Type of gear box (MT/AT/CVT)	
	2.11	No. of forward gears	
	2.12	Transmission ratio	
	2.13	Axle ratios & Type	
	2.14	Vehicle Maximum speed, Km/hr	
	2.15	Number of Fan Blades	
	2.16	Fan Type (Mechanical / Viscous / Electric)	
	2.17	Fan Speed, rpm	
	2.18	Fan Design (Fan shroud, Blade Material, thickness, profile & design details)	
	2.19	Noise shield if provided in engine compartment and transmission system a)Material b)Thickness c)Location	
	2.20	Type of Suspension	
	4.0	**Fire Detection and Suppression System (FDSS)**	
	4.1	Name and address of manufacturer of the fire suppression system	
	4.2	Type of the fire suppression system	

	4.3	Test report number of the FDSS	
	4.4	Extinguishing agent (make and type):	
	4.5	Mass of extinguishing agent:	
	4.6	Type of discharge point(s):	
	4.7	Length of discharge tube	
	4.8	Number of discharge points(s):	
	4.9	Type of propellant gas, if applicable:	
	4.10	Pressure of propellant gas	
	4.11	Minimum operating temperature	
	4.12	Dimensions of pipes and fittings	
	4.13	Detailed description, layout drawings and installation manual of the fire suppression system and its components	
	5.0	**Kneeling System (Yes/No)**	
	5.1	Floor Height	
	5.2	Kneeling Height	
	5.3	Location of switch for operation of kneeling system for downward, upward and stop position.	
	6.0	**Emergency Lighting System (Yes/No)**	
	6.1	Location of switch	
	6.2	Min. Time for activation	
	6.3	Location of power supply	
	6.4	Colour of light	
	7.0	**Escape Hatches**	
	7.1	Number	
	7.2	Aperture Area	
	7.3	Location of Hatches (Roof/Floor)	
	7.4	Distance between hatches (If number of hatches are more than one)	
	7.5	Type of Roof Escape hatch (Ejectable/Hinged/Readily breakable Safety Glass)	
	7.6	If escape hatch is hinged type, angle of hinge	

	8.0	**Priority Seats**	
	8.1	Forward/Rearward facing	
	8.2	Number	
	8.3	Width of priority seat cushion	
	8.4	Height of uncompressed seat cushion from floor.	
	8.5	Free height above priority seat	
	9.0	**Wheelchair**	
	9.1	Forward facing/ Rearward facing	
	9.2	Wheelchair accommodation provisions	
	9.2.1	Width	
	9.2.2	length	
	9.3	Percentage of Slope	
	9.4	Height of wheelchair access door	
	9.5	Width of wheelchair access door	
	9.6	Foldable or detachable seats in wheel chair area provided (Yes/ No)	
	9.7	Type of wheelchair restraint system	
	10.0	**Pram or push chair**	
	10.1	Accommodation provisions	
	10.1.1	Width	
	10.1.2	length	
	11.0	**Boarding Devices**	
	11.1	Type Lift/Ramp	
	11.2	Area of boarding	
	11.2.1	Length	
	11.2.2	Width	
	11.3	Load Carrying capacity of boarding device	
	11.4	Slope of ramp in %	
	11.5	Slope of extended ramp if provided in %	
	11.6	Mode of operation of ramp (Manual/ power operated)	
	12.0	**Multiplexer (Give Details for each Node)**	

	12.1	Make	
	12.2	Model	
	12.3	Hardware Version	
	12.4	Software Version	
	12.5	Part No	
	13.0	**Public Information System (Give Details for Front/Rear/Side/Internal Display)**	
	13.1	Make	
	13.2	Model	
	13.3	Hardware Version	
	13.4	Software Version	
	13.5	Part No	
	14.0	**Singe Controller Unit (SCU) - If Fitted**	
	14.1	Make	
	14.2	Model	
	14.3	Hardware Version	
	14.4	Software Version	
	14.5	Part No	
	15.0	**Bus Driver Console (BDC)- If Fitted**	
	15.1	Make	
	15.2	Model	
	15.3	Hardware Version	
	15.4	Software Version	
	15.5	Part No	
	16.0	**Security Camera Network- If Fitted**	
	16.1	Make	
	16.2	Model	
	16.3	Hardware Version	
	16.4	Software Version	
	16.5	Part No	
	17.0	**Announcement System (Mic/Amplifier) If Fitted**	
	17.1	Make	
	17.2	Model	

	17.3	Hardware Version	
	17.4	Software Version	
	17.5	Part No	

APPENDIX – VIII

(See Introduction)

List of Participants

APPENDIX IX

(See Introduction)

AISC Committee