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Road vehicles — Bus body design and construction — Specification

PUBLIC REVIEW DRAFT



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PUBLIC REVIEW DRAFT

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Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Trade, Industry and Cooperatives established under Cap 327, of the Laws of Uganda, as amended. UNBS is mandated to co-ordinate the elaboration of standards and is

- (a) a member of International Organisation for Standardisation (ISO) and
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Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

The committee responsible for this document is Technical Committee UNBS/TC ###, *[name of committee]*, Subcommittee SC ##, *[name of subcommittee]*.

PUBLIC REVIEW DRAFT

Road vehicles — Bus body design and construction — Specification

1 Scope

This Draft Uganda Standard specifies requirements for bus body design and construction.

This standard applies to buses with bodies designed and constructed for carriage of persons. This standard does not include provisions for persons of reduced mobility.

This standard applies to buses as defined in DUS ISO 3833.

2 Normative references

UNRA Vehicle Dimension Regulations 2017 and Ministry of Works: Volume 1: Volumetric Design Manual

3 Terms and definitions (mandatory)

For the purpose of this Uganda Standard the following definitions shall apply:

3.1

vehicle/bus

vehicle with at least four wheels designed and equipped for the transport of passengers and on account of its design and appointments, is intended for carrying persons and luggage and which has more than 9 seating places including the driving seat. It may have one or two decks and may also tow a trailer.

2. 2 Types of buses (refer to ISO 3833)

2.2.1

articulated bus or coach

vehicle, which consists of two or more rigid sections, which articulate relative to one another. The passenger compartments of each section intercommunicate so that passengers can move freely between them. The rigid sections are permanently connected so that they can only be separated by an operation involving facilities which are normally only found in a workshop

2.2.2

low floor bus

vehicle in which at least 35% 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

2.2

approval of a bus

approval of a bus type with regard to the constructional features specified in this standard

2.3

Service door

door used by passengers in normal circumstances providing access to and from the bus

- 2.4**
Double door
door affording two, or the equivalent of two access passages
- 2.5**
Emergency door
door additional to the service door(s) intended for use as an exit by passengers in an emergency only
- 2.6**
Emergency window
window, not necessarily glazed, intended for use as exit by passengers in an emergency only
- 2.7**
double emergency window
an emergency window which, when divided into two by an imaginary vertical line (or plane), exhibits two parts each of which complies as to dimensions and access with the requirements applicable to a normal emergency window
- 2.8**
escape hatch
roof provision intended for use as an exit by passengers in an emergency only
- 2.9**
Emergency exit
an emergency door, emergency window or escape hatch
- 2.10**
exit
Means a service door or emergency exit
- 2.11**
floor or deck
That part of the body work whose upper surface supports standing passengers, the feet of seated passengers and the driver and these at mountings
- 2.12**
gangway
The passage providing access to passengers from any seat or row of seats to any other seat or row of seats or to any access passage from or to any service door; it does not include:
- a) the space extending 30cm in front of any seat;
 - b) the space above the surface of any step or stair case; or
 - c) any space, which affords access solely to one seat or one row of seats.
- 3.13**
access passage
The space extending inwards into the vehicle from the service door up to the outermost edge of the upper step (edge of the gangway). Where there is no step at the door, the space to be considered as access passage shall be up to a distance of 30cm from the seating position of the inner face of a dual panel.
- 3.14**
driver's compartment
the space intended for the driver's exclusive use and containing the driver's seat, the steering wheel, controls, instruments and other devices necessary for operation of the bus.

3.15**Tare mass(MK)(kg)**

The mass of the bus in running order un occupied and un-laden

NOTE1: Unless otherwise stated, all measurements shall be made when the bus is at its unladen kerb mass (MK) (kg) and it is standing on a smooth and horizontal ground surface. If a kneeling system is fitted to the vehicle, it shall not be in operation.

3.16**technically permissible maximum mass**

The maximum mass declared by the manufacturer of the bus. (This mass may be greater than the "permissible maximum mass" to be prescribed by national administrations)

NOTE2: Wherever there is a requirement in this standard for a surface in the bus to be horizontal or at specific angle when the vehicle is at its un laden kerb mass (MK) (kg), in the case of a bus with mechanical suspension, the surface may exceed his slope or possess a slope when the bus is in the loading condition declared by the manufacturer. If a kneeling system is fitted to the vehicle, it shall not be in operation.

3.17**technically permissible maximum axle mass**

That part of the technically permissible maximum mass of the bus, declared by the manufacturer, which results in the vertical force at the road surface in the contact area on the wheel/wheels of an axle. This mass may be greater than the maximum permissible axle mass authorized by national administrations. The sum of all technically permissible maximum axle masses of the bus may be greater than the technically permissible maximum mass of that bus

3.18**passenger**

person other than the driver or a member of the crew

3.19**passenger with reduced mobility**

A passenger who has a special difficulty when using public transport, especially elderly and disabled person. Reduced mobility does not necessarily imply any form of medical impairment

3.20**passenger compartment**

The space intended for passengers use excluding any space occupied by fixed appliances such as bars, kitchenettes or toilets

3.21**automatically operated service door**

power-operated service door which can be opened (other than by means of emergency controls) only after a control is operated by a passenger, and after activation of the controls by the driver, and which closes again automatically

3.22**motion prevention device**

device, which prevents the bus from being driven away from rest when a door is not fully closed;

3.23**driver operated service door**

service door, which normally is opened and closed by the driver

3.24**RHS**

rectangular hollow section

3.25

M.S

Mild Steel

3.26

can trail

Longitudinal stiffeners that provide support over the windows of the bus

3.27

MIG

Metal inert gas

3.28

TIG

Tungsten inert gas

3.29

MMAW

manual metal arc

3.30

CIDECT

The International Committee for Research and Technical Support for Hollow Section Structures

3.31

ASI

Australian Steel Institute

3.32

Kerb mass/Tare mass/kerb weight

weight of your tow vehicle when initially delivered by the manufacturer (with no occupants, 'cargo' or other accessories)

3 Categorization of Buses

. A "bus Category" means buses which do not differ in the following essential aspects

1. Vehicle Concept (Designed Capacity- The number of Passengers)
2. Body work type and Concept (Single, double deck, Low flow , articulated body concept
3. Vehicle Purpose or use (Urban, interurban , Long distance)

3.1 Bus Types

This categorization is based on function:

3.1.1 Urban Bus : A bus which is designed and equipped for Urban and Sub-urban use; this class of vehicle has seats and places intended for standing passengers and allows for the movement of passengers corresponding to frequent stops.

3.1.2 Inter-Urban Coach: A bus which is designed and equipped for Interurban transport. This vehicle has no place which is specifically intended for standing passengers, but it can carry standing passengers for short distances in the gangway.

3.1.3 Long Distance Coach: A bus which is designed and equipped for long distance journey; this vehicle is concerned with the comfort of its seated passengers and standing Passengers are not carried.

3.1.4 Articulated bus or coach is a vehicle, which consists of two or more rigid sections, which articulate relative to one another. The passenger compartments of each section intercommunicate so that passengers can move freely between them. The rigid sections are permanently connected so that they can only be separated by an operation involving facilities which are normally only found in a workshop.

3.1.5 Trolley bus: A bus which is electrically propelled by energy from external overhead contact wires.

3.1.6 Low Floor Bus: A vehicle which has at least 35 percent of the area available for standing passengers

3.1.7 Double Deck Bus: Means a vehicle where the provided spaces for passengers are arranged, at least in one part in two superimposed levels and spaces for standing passengers are not provided in the upper deck.

3.1.8 : Special bus: A bus whose characteristics are included in none of the above categories: Special buses may include; Sleeper coach, school bus, transport bus, Ambulances, off-road bus , Specially constructed buses for Prisons, Police or Armed forces.

3.2 Bus Classes;

This categorization is based on the seating capacity:

Class I: Micro-buses with a seating capacity of up to14 passengers; This includes a category of Light omni buses as defined in the traffic and road safety Act of 1998

Class II: Mini-buses with a seating capacity of 15—25 passengers; This includes a category of Light and medium omni buses as defined in the traffic and road safety act of 1998

Class III: Medium-buses with a seating capacity of 26—40 passengers; This includes a category of medium omni buses as defined in the Traffic and road safety Act of 1998.

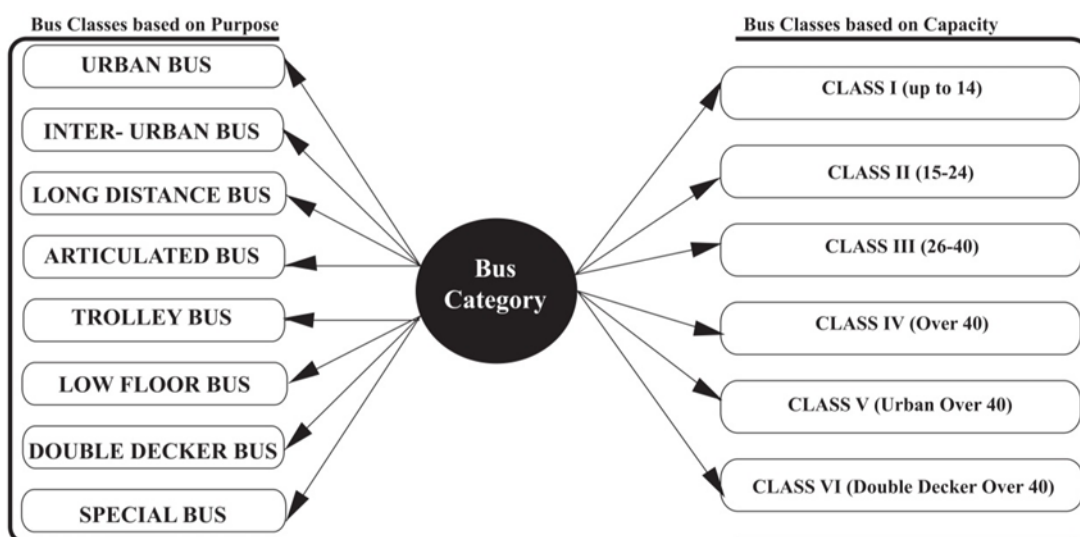
Class IV: Buses with a seating capacity of over 40 passengers; This includes a category of medium omni Buses and heavy omni buses as defined in traffic and road safety act of 1998.

Class V: Urban buses with a capacity of over 40 seated passengers; This includes a category of medium omni Buses and heavy Omni buses as defined in traffic and road safety act of 1998.

Class VI: Double decker buses with a capacity of over 40-seated passengers.

Note:

- i. Any of the above bus classes shall fall under one or more bus types already presented and vice versa
- ii. The carrying capacity shall also conform with the provisions of the traffic and road safety act



Bus Categorization

4 Bus External dimensions and Weights

4.1 Overall length

The overall length of the bus, if rigid, including any load, shall not exceed 12,500 mm. the overall length of the bus if articulated, shall not exceed 17 400 mm; or the overall length of any combination of buses (presented as one vehicle) shall not exceed 22 000 mm.

4.2 Overall width

The overall width of any bus body shall not exceed 2.65 excluding side mirrors.

4.3 Overall Height

The overall height of the highest point of the bus, including any load shall not exceed 4.3 meters from the surface of the road.

All provisions regarding vehicle dimensions and weights as specified in the UNRA Vehicle Dimension Regulations and subsequent revisions shall apply.

5 Lighting & Illumination

5.1 Lighting, Signaling and Indicating Systems

5.1.1 External

External lighting and light-signaling devices of the bus shall comply with the chassis frame manufacturers specification for the external lighting.

All lighting and light-signaling devices shall be Type Approved”

5.1.2 Internal

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.

5.2 Position of illumination devices

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

- a) Cab lamp or courtesy lamp
- b) Passenger area lamps

The following lamps are to be placed at door apertures

- a) Exit lamps

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

- a) Locker lamp
- b) Electrical distribution centre lamp - Instrument lighting
- c) Control unit lamps

5.3 Driver Cabin lighting

The following lamps fall in this category:

- a) Cab lamp or courtesy lamp
- b) Locker lamp
- c) Electrical distribution lamp

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.

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.

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

5.4 Passenger Compartment lighting

The following lamps fall in this category:-

- a) Exit lamps
- b) Passenger area lamps

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.

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.

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

5.5 Other Area Lightings

Luggage hold area lighting: Every luggage hold shall be provided with light fittings for illuminating the hold when in use.

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.

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.

6 Inspection and criteria of conformity

6.1 During Production

Every bus shall be inspected by an engineer accredited by the Ministry of works and Transport or any recognized Engineering professional boby at end of the framing stage, for the integrity of the welding and materials used in the building of the frame and the body. They will sign for conformity of this frame, using the form in annex B

6.2 Final Inspection

Every bus shall have an approval mark, in the form of plate, issued by the relevant Government Authority as prescribed in this standard after undergoing sufficient random inspection. Approval granted shall be withdrawn if this requirement is not complied with and production discontinued.

Every bus shall be inspected in accordance with the requirements of US 479, code of practice for inspection of road vehicles. A bus shall be inspected with all parts and accessories in place. The accredited engineer shall sign for conformity, using the form in annex B.

7 Requirements

7.1 Conformity of production

7.1.1 Accreditation of body builders

All body builders shall be accredited by the Ministry responsible for Transport.

7.1.2 Approval of bus designs

Approvals for vehicle designs shall be done by Ministry responsible for Transport.

7.1.3 Application for approval

Application for approval of a vehicle type, with regard to its constructional features, shall be submitted by the vehicle body builder to Ministry responsible for Transport

7.1.3.1 The application shall include a detailed description of the vehicle type, its structure, dimensions, configuration, and constituent materials. The following shall also be submitted:

- a) drawings of the bus and its interior arrangements;
- b) the unladen mass of the bus in kg;
- c) the intended total number of passengers (N) as calculated in Annex A;
- d) the class and type for which approval is requested.

NOTE This approval is deemed valid for the submitted design, any variations to the designs shall see re-approval.

7.2 Bus shall be built by approved body builders in accordance with requirements of this standard and shall conform to 4.1.4.3 Drilling and welding of chassis (welding standard)

7.2.1 Attachments to the chassis frame.

- a) The body structures shall not be welded to the chassis frame.
- b) Brackets shall be bolted to the chassis frame in line with vehicle manufacture's specifications.

7.2.2 Welding of body structure and cladding

7.2.2.1 Welding Types

Arc welding shall be limited to the welding of angle iron or channel iron sections in excess of 6mm, to chassis mounting brackets.

The MIG and TIG equipment shall be employed for welding all other material including RHS, lip channel and cladding sheets.

7.2.2.2 Welders

Welders shall be required to have a welders certificate from an accredited institution by a local/international certification.

7.3. Bus chassis frame drilling

Drilling shall follow the chassis frame manufacturer’s recommendations and shall achieve a "pushfit" with the fixings employed.

7.4 Body sections

The materials used shall be Q345 or equivalent and dimensions of body sections shall be as specified in Table1,

7.4.1 Body Section Properties

For the required section properties and dimensions to use during the design and construction of bus body, the Limit State Design method is to be used basing on the maximum design load application during service or use.

7.4.1.1 Hollow Sections

With the limit service loads determined , the Hollow Sections dimensional and profile properties shall be referenced from the Design Capacity Tables for Structural Steel for Hollow Sections (Design Guide 6 and 7) by CIDECT or any equivalent standard.

7.4.1.2 Channel Sections

Channel Section dimensions and profile properties shall be selected and used with reference to the Design Capacity Tables for Structural Steel for Open Sections by ASI or any equivalent standard

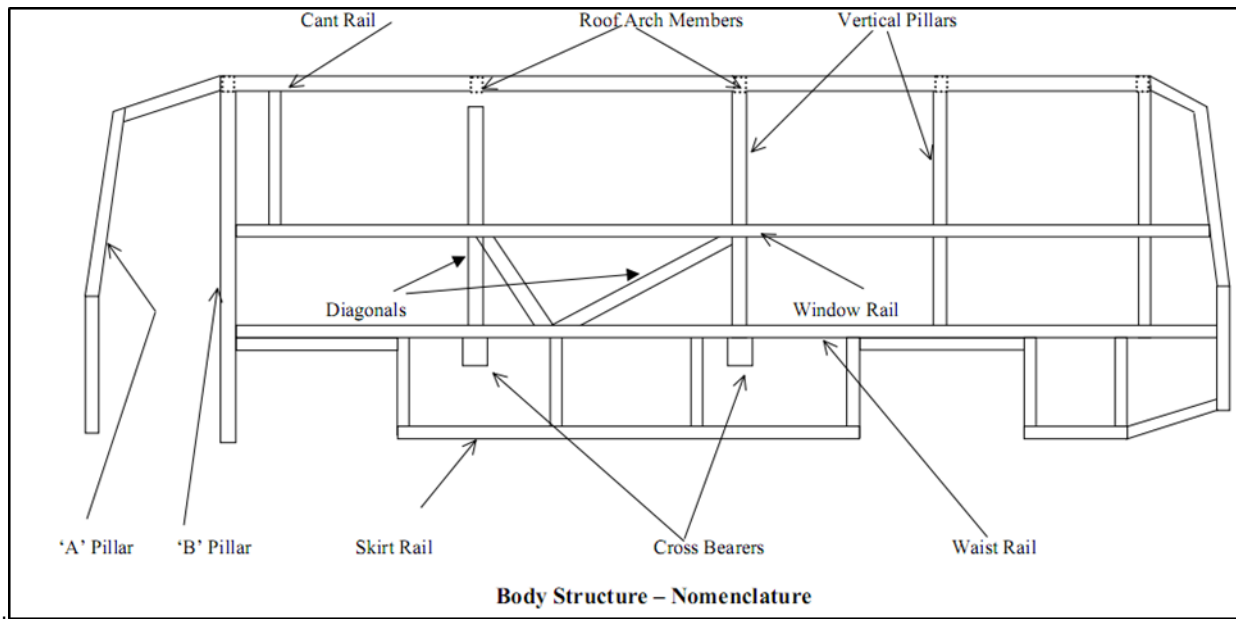
7.4.1.3 Joinery Method

For assembly and fabrication method guidance use CIDECT Design Guide 7 or any equivalent while for the welded joints that are operating under fatigue and static loading use CIDECT Design Guide 8.

Body sections	Class II, III	Class IV,V,VI
Body cross members	As a minimum RHS 100 mm x 50 mm x 3 mm shall be used Rectangular Hollow Section or Square section with properties to withstand maximum design load application in 4.4.1 and dimensional properties referenced to structural standard in section 4.4.1.1 shall be used with approval by a qualified structural engineer For joinery method refer to section 4.4.1.3	As minimum a RHS 100 mm x 50 mm x 6 mm shall be used I Channels with properties to withstand maximum design load application in 4.4.1 and dimensional properties referenced to structural standard in section 4.4.1.2 shall be used with approval by a qualified structural engineer For joinery method refer to section 4.4.1.3
Seat Anchorage Side verticals Side horizontals	RHS 50mm x 50mm x 1.5mm or SHS 50mm x 25mm x 1.5mm as a minimum shall be used. Rectangular Hollow Section or Square section with properties to withstand maximum design load application in 4.4.1 and dimensional properties referenced to structural standard in section 4.4.1.1 shall be used with approval by a qualified structural engineer	RHS 50mm x 50mm x 3mm or SHS 50mm x 25mm x 3mm as a minimum shall be used. Rectangular Hollow Section or Square section with properties to withstand maximum design load application in 4.4.1 and dimensional properties referenced to structural standard in section 4.4.1.1 shall be used with approval by a qualified structural engineer

	For joinery method refer to section 4.4.1.3	For joinery method refer to section 4.4.1.3
Floor covering	3.0mm Mild Steel. chequerplate 2.5mm Mild Steel. (flat) plate with anti-skid covering 10mm Marine ply with floor covering	
Window Spacing	Minimum: 940 mm Maximum: 1150 mm	
Window height	Sliding: 600 mm Fixed: 430 mm	
Sliding window position	Top position for all school buses and either position for other applications(see Figure2)	
Cant Rail	Define structural mechanism using any appropriate proven scientific method to define the loading application and select appropriate section as guided by section 4.4.1.1 & 4.4.1.2 Perform structural analysis for the design and make necessary changes with consultation and approval by a qualified structural engineer	
Roof Arches Roof Longitudinal	Define structural mechanism using any appropriate proven scientific method to define the loading application and select appropriate section as guided by section 4.4.1.1 & 4.4.1.2 Perform structural analysis for the design and make necessary changes with consultation and approval by a qualified structural engineer For joinery applications please refer to section 4.4.1.3	
Outer cladding	0.5 mm Mild Steel Galvanized (glued skin) 0.8 mm Mild Steel Galvanized (welded skin) 1mm Aluminum plate	
Inner Cladding	0.5 mm Mild Steel Galvanized (glued skin) 0.8 mm Mild Steel Galvanized (welded skin) 0.8 mm Aluminum plate Note: Shall have full coverage with no sharp edges.	
A Pillar B Pillar Window Rail Skirt Rail	Rectangular Hollow Section or Square section with properties to withstand maximum service lateral and axial loading as a minimum shall be considered. Dimensional properties cross referenced with structural standard in section 4.4.1.1 shall be used with approval by a qualified structural engineer For joinery applications please refer to section 4.4.1.3	
Diagonals	Rectangular Hollow Section or Square sections shall be designed as zero force members For joinery applications please refer to section 4.4.1.3	

Table1—Material and dimensions of body sections



Design Vehicle Type	Height	Width	Length	Minimum Design Turning Radius (m)	Minimum Design Inside Radius (m)
Class I	1.3-1.5	Up to 2.1	Up to 5.8	7.3	4.2
Class II, III	Up to 4.1	Up to 2.6	Up to 9.1	12.8	8.5
Class IV, V, VI	Up to 5	Up to 2.6	Single unit 12.5 Articulated 17.m Joined up to 22	12.8	7.4

7.5 Gangways

7.5.1 Floor to roof height

The minimum inside floor to roof height for bus classes (as specified in clause 3) II and III shall be minimum 1700mm, while for buses of classes IV, V and VI shall be minimum 1900mm.

7.5.2 Gangway measurements

The gangway for public service vehicle shall be so designed and constructed as to permit the free passage of gauging devices whose dimensions are as specified in Table 2 and as illustrated in Figure1.

Table2 — Gangway measurements in mm

Dimensions	ClassII	ClassIII	Class IV,V and VI
------------	---------	----------	-------------------

Diameter of lower cylinder	305	350	450
Height of lower cylinder	900	900	900
Diameter of upper cylinder	356	550	550
Height of upper cylinder	500	500	500
Overall height	1700	1800	1900

Buses of class VI shall conform to claus 33 (2) of the Traffic and Road Safety Act which states that 'no part of any gangway which serves as a joint means of access from any entrance to both an upper and a lower deck of a bus shall be less than 915mm in width

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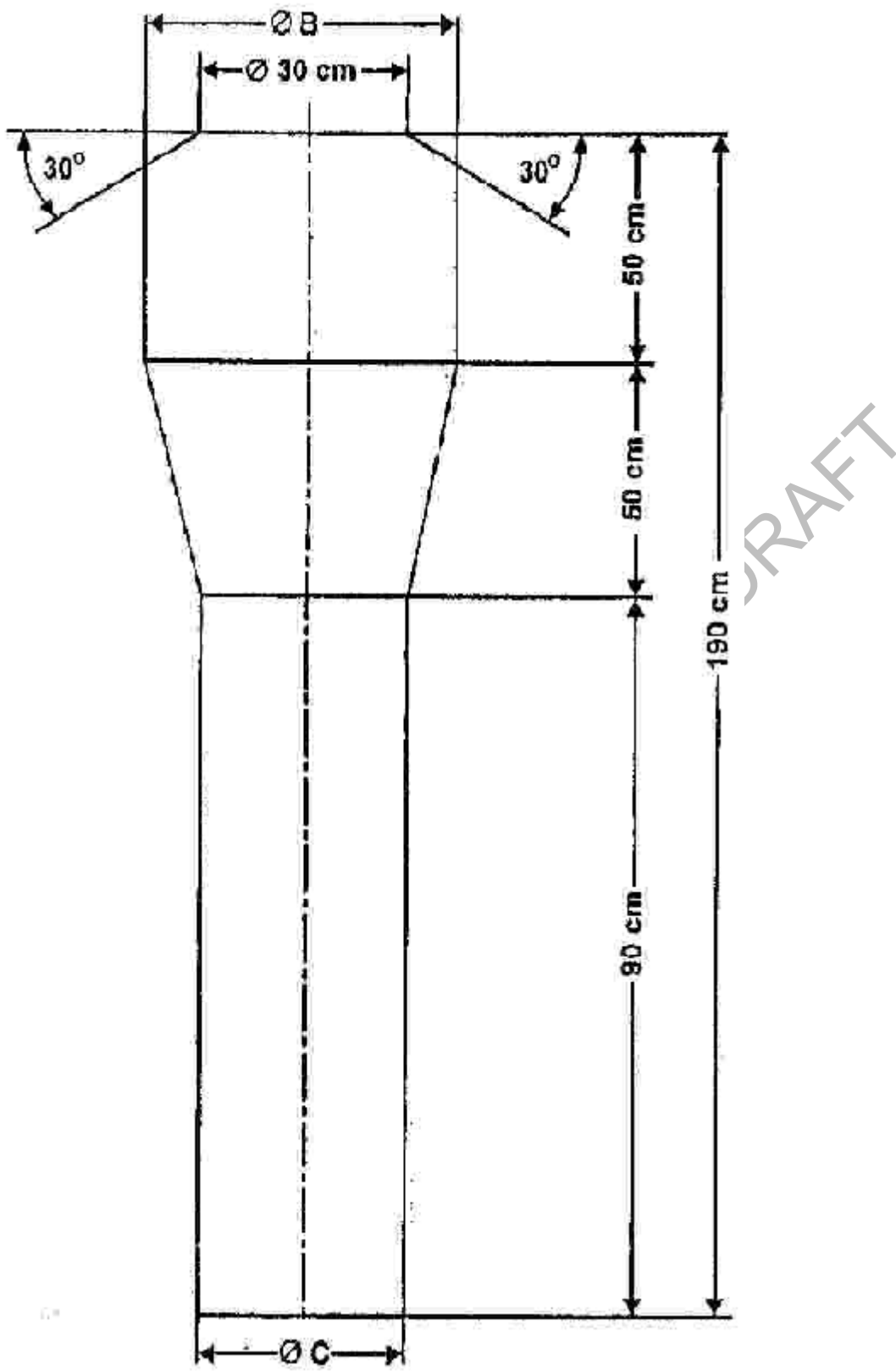


Figure 1—Gangway gauging device

7.6 Windows

7.6.1 Window design and construction

The recommended windows design for buses of class I, IV, V and VI shall be made of three parts, as shown in the Figure 2. Window dimensions shall be as specified in Table 1. (research on window design)

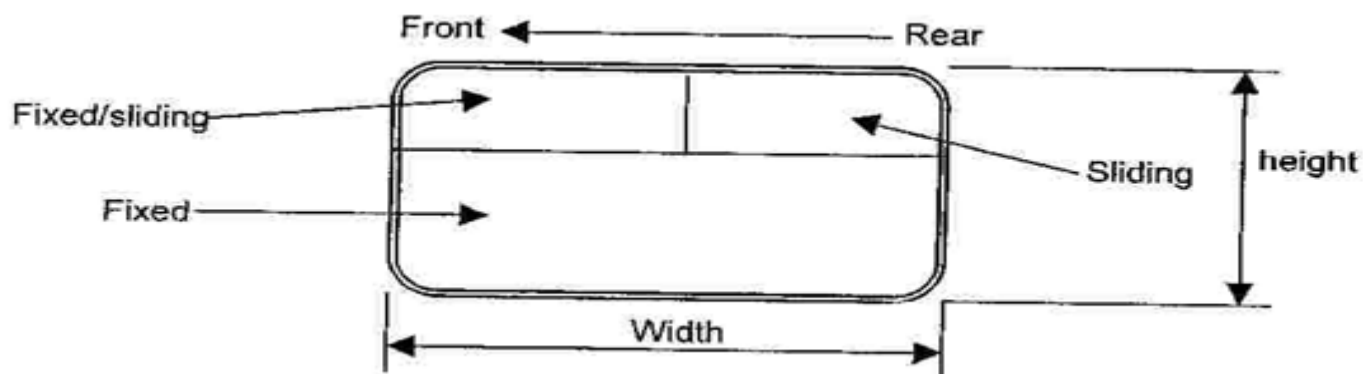


Figure 2 Typical window design

7.6.2 The windows shall be fixed to the vertical pillars firmly

7.6.3 Window fittings shall be of good quality and weather proof.

7.6.4 The windows shall be so designed and constructed as to allow proper view and ventilation.

7.6.5 Compliance of window glass

Window glass and windscreens shall comply with the Specification in the Traffic and road safety Act for automotive windscreens.

7.6.6 Compliance of windscreen

7.6.6.1 The windscreen and side-windows of the driver's compartment shall be constructed as to give the driver adequate view ahead and to either side at an angle of at least 90° from the centre line of the vehicle.

7.6.6.2 The corner posts and pillars supporting the windshield shall be 100mm max. and 50mm max respectively. They shall be so designed and constructed such that they do not impair driver's visibility as in 4.6.6.1.

7.7 Entrance doors/exits

Entrance and exits of the vehicle shall be through service door(s) or double door(s) situated on the left side of the vehicle, whose minimum height for class II, III and IV shall be 1650mm, and for class V, 1800mm while the minimum width for single door shall be 450mm and for double shall be 1200mm.

7.8 Service Doors

The minimum number of service doors required is as follows:

- a) class V and VI vehicle shall have minimum two double doors;
- b) class III and IV shall have minimum one service doors.

7.8.1 Entrance and service doors shall not be deemed to be an emergency door

7.9 Emergency exits

All vehicles shall be provided with at least one unhindered emergency exit with a clearly marked direction of opening.

7.9.1 Emergency doors

Emergency doors shall be clearly marked and capable of being opened from inside and from outside when the vehicle is stationary.

7.9.1.1 Emergency doors shall not be of the power-operated or the sliding type.

7.9.1.2 Emergency doors shall be installed in the normally closed position.

7.9.1.3 Emergency doors located at the back of the vehicle shall have an opening of height not less than 1250mm and width not less than 550mm or an area of 690000sq mm.

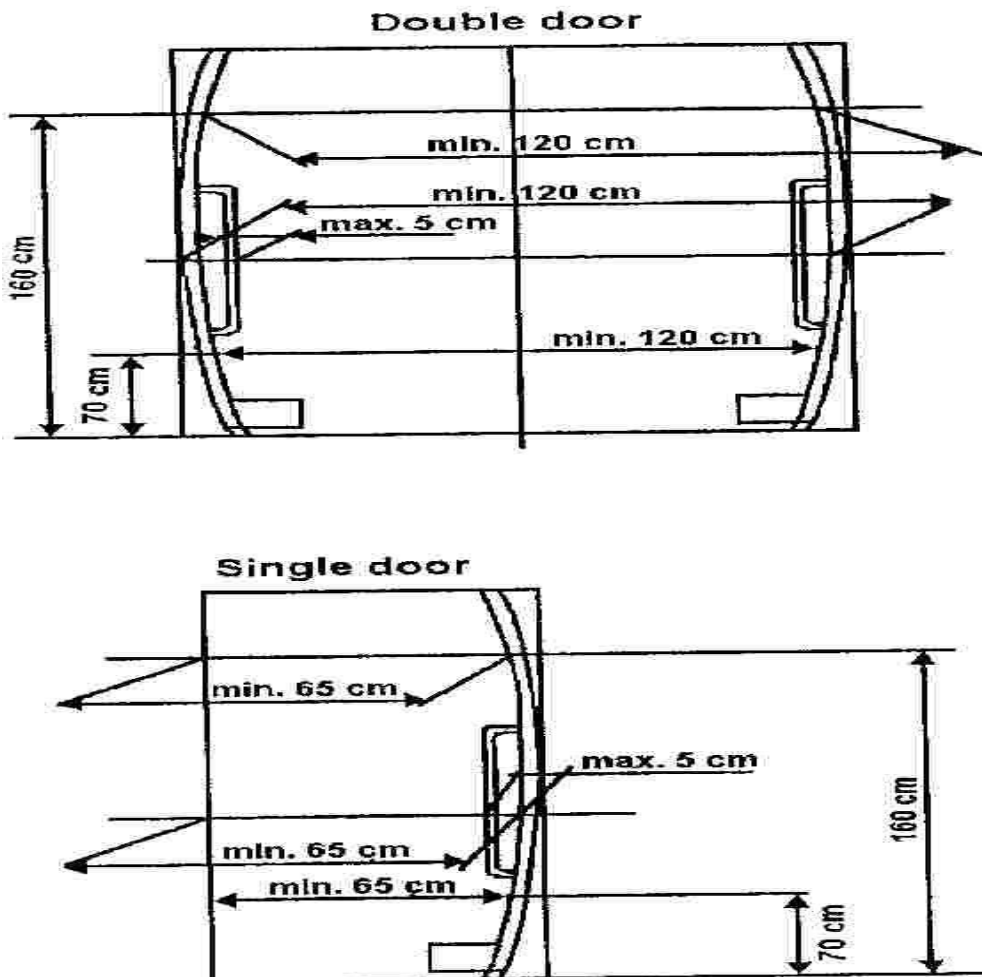


Figure3—Doors

7.9.2 Emergency windows

7.9.2.1 Emergency windows shall be rectangular, measuring 700mm x 500mm minimum or an area of 350000sq mm.

7.9.2.2 Every hinged emergency window shall open outwards.

7.9.2.3 Every emergency window shall be capable of being easily and instantaneously operated from inside and from outside the bus by means of a device recognized as satisfactory by the authority,

7.9.3 Emergency glass

An emergency exit door/window made of glass shall comply with the dimensions described above in clause 4.9.2.1 and 4.9.2.2 and shall be made of breakable safety glass. This shall present the possibility of using panes of laminated glass or plastic material

7.10 Ventilation

Every bus shall be fitted with suitable ventilation constructed such that it shall under normal use, not leak rain water into the vehicle.

7.11 Hand-rails and hand-holds

Every urban bus belonging to class III, IV, V and VI shall be provided with hand-rails and hand-holds which are of adequate strength and so designed and installed as to present no risk of injury to passengers. Every hand-rail shall provide a length of at least 100mm to accommodate a hand. The hand-rails shall have a diameter greater than 20mm and less than 45mm except for hand-rails on doors and seats

A hand rail shall be able to withstand without snapping a traction force of 1400N applied statically in the direction of application to the centre surface of the hand rails between the two supportive successive support points.

7.12 Passenger seats (including folding seats and space for seated passengers)

7.12.1 Minimum seat width shall be as specified in Table 3 and as illustrated in Figure 4.

	F minimum	G minimum	
		Continuous seats	Individuals eats
Class IV and V	200	225	250
ClassIII	200	225	250
ClassII	225	225	250

Table3—Minimum seat width in mm

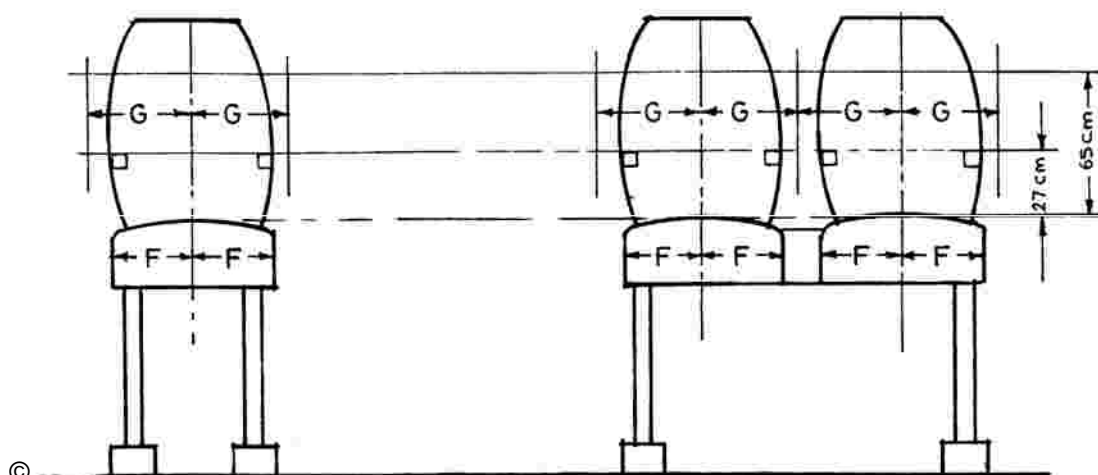


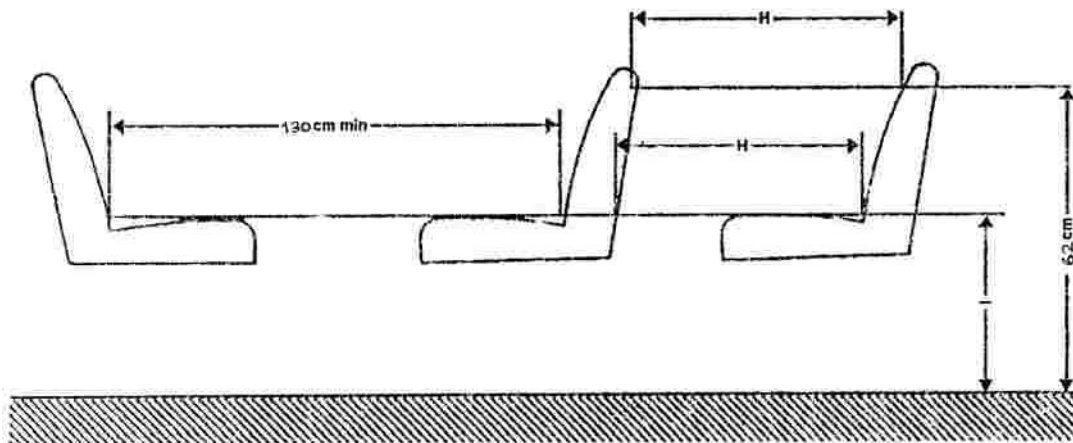
Figure4 — Width of passenger seats

7.12. Seat spacing and cushion height

The minimum seat spacing for leg room shall be 660mm for class V and VI, while for other classes the minimum seat spacing shall be 680mm, when the seats are arranged one behind the other as illustrated in Fig 5.

7.13 Seat anchorage

The seats shall be firmly bolted on the floor steel frame and not on floor sheets with bolts complying with US ISO 898. The general seat construction shall be as stated in Figure 5. The tubes used in the construction of seats shall be round or oval shaped and of minimum 25mm diameter and minimum 2mm thickness and of grade A.



Where

H seat spacing

I Cushion height

Figure5—Seat spacing and cushion height

7.14 Seat belts anchorage

The seat belts and their anchorage fitted in bus class II meet the requirements specified in US 546 Specification for seat belt assemblies for motor vehicles and US 545, Specification for anchorages for seat belts — Automobiles.

All buses shall be provided with 3-point seat belts for the driver's seat, the co-driver's seat as shown in Figure 6. The other seats may be provided with 2-point seat belts.

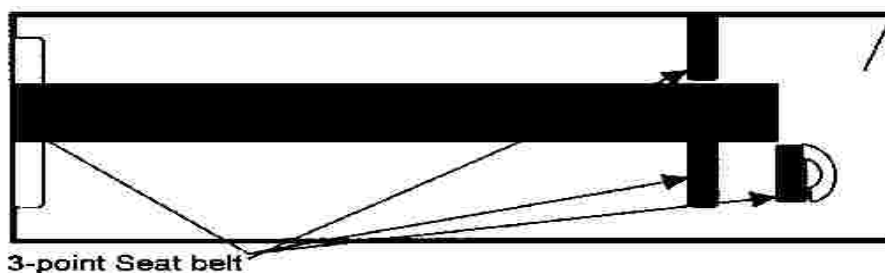


Figure 6—Seat belt anchorage for vehicles

7.14.1 All other classes of vehicles shall be provided with seat belts for each seat.

7.15 Cushions

If used, cushions for the seat and backrest shall be made of high-density foam conforming to US 202-2, Specification for flexible polyurethane foams.

The combination of the plywood and foam must be reinforced with steel sections or flat bar of 25 mm x 3 mm.

7.16 Interior lighting and bell switches

All vehicles shall have interior lights operated by the driver and passengers. All vehicles shall also have at least two bell switches, operated by the passengers to alert the driver to stop. The bell switches shall have a minimum distance of 300 mm from the driver's partition and 610 mm from the rear.

7.17 Engine and cabin noise

Non-flammable sound-proof material (s), which are not liable to be impregnated with fuel or lubricant, shall be used in the engine compartment for noise reduction.

Vehicles shall be constructed such that engine noise shall be limited to 90 decibels inside the vehicles.

7.18 Height above ground and steps for passengers

The lowest step for entering into the vehicle shall not exceed a height of 460 mm from the ground. D shall be the height above the ground of vehicle unladen as shown in Fig 7

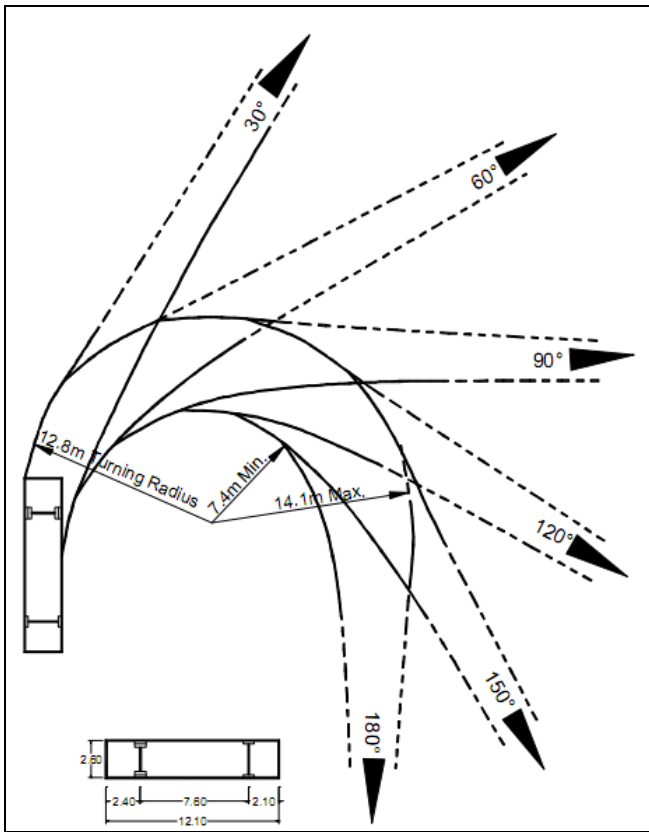


Figure 3: Class IV, V and VI

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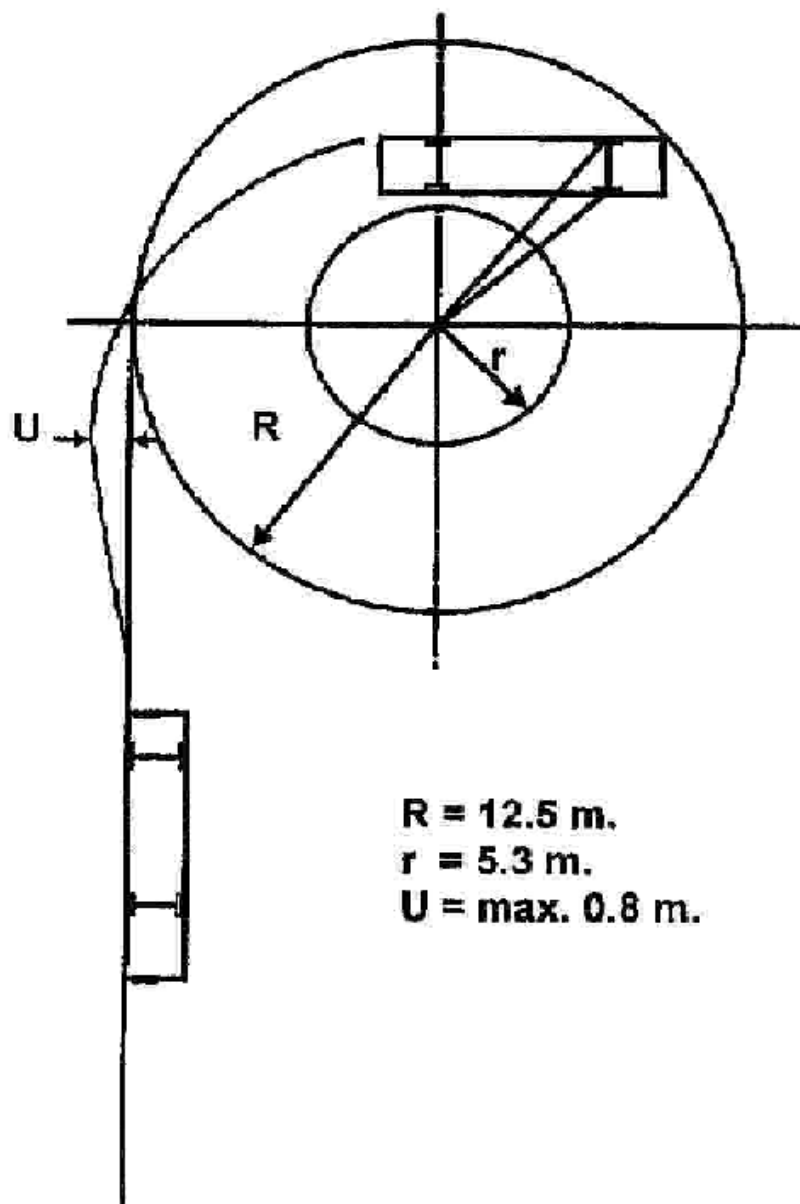


Figure8—Vehicle manoeuvrability

7.23 Protection against fire risks

A partition of heat-resistant and shielding material (s) shall be fitted between the engine compartment or other source of heat and rest of the vehicle.

7.24 Fuel tanks

Fuel system assembly shall be in accordance with US???, Recommendation for fuel tank assembly for automotive.

Every fuel tank shall be securely fixed. No part of a fuel tank shall be less than 600 mm from the front of the bus or less than 300 mm from the rear bus so as to provide protection in the event of front or rear impact.

No part of the fuel tank shall project beyond the overall width of the bodywork.

Fuel tanks shall be made so as to be corrosion resistant.

7.25 Fuel-feed systems

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

Fuel lines and all other parts of the fuel-feed system shall be accommodated in the positions on the bus where they have the fullest protection.

Twisting or bending movements and vibrations of the bus structure or the power unit shall not subject the fuel lines to abnormal stress.

7.26 Fuel filler holes and caps

7.27 Fuel filler holes shall be accessible only from outside the vehicle.

7.27.1 Fuel filler holes shall be not less than 500 mm from any door aperture when the fuel tank is intended to contain petrol, and not less than 250 mm when it is intended to contain diesel fuel; they shall moreover not be in the passenger compartment, nor in the driver’s compartment. Fuel filler hole caps shall be so designed and constructed that they cannot be opened accidentally.

7.28 Fire extinguisher

Space shall be provided for fitting one or more fire extinguishers, such that one is near the driver’s seat and the space provided for each measuring not less than 600 mm x 200 mm x 200 mm.

8 Electrical Equipment and Wiring

8.1 Electrical Cables

All cables used shall be compliant with ISO 6722 and shall be able to withstand working temperature up to 70°C.

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, and nicking, cutting, abrasion or chaffing.

The conductor cross section shall be selected to carry the rated current as given below (Specification for Low Tension Wire for Automotive Application) or according to one of the standards mentioned above.

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

Specification for Low Tension Wire for Automotive Application

Single-core, unfinned, PVC-insulated. Permissible working temperature: 70oC.2)							
Nominal conductor cross-sectional area mm ²	Approx. number of individual strands ¹⁾	Maximum impedance per meter ¹⁾ at +20oC mΩ/m	Maximum conductor diameter 1) mm	Nominal thickness of insula- tion1) mm	Maximum external diameter of insulated wire1) mm	Permissible continuous current (guide figure) ²⁾ at ambient temperature of	
						+30oC A	+50oC 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.

Table 1. Electrical copper conductors for motor vehicles

8.2 Fuse

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

8.3 Terminals, Connectors & Elements

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

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

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

8.4 Safety requirements

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

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

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.”

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

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.

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.

Electrical conductors shall meet the requirement for flame resistance specified in paragraph 6.8.

8.5 Batteries

All batteries shall be well secured and easily accessible.

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

Battery terminals shall be protected against short circuit risk.

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

8.6 Electrical Wiring and Circuits

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

Description	Standard No.(Local or International)
Cables for Motor Vehicles	IEC 60793
Cable Termination for Automobile Wiring Blade Type Connectors	TBD
Cable Termination for Automobile Wiring Bullet & Tube Type Connectors	TBD
Low Voltage Fuses	IEC 60269
Colour Code of Electrical Wiring for major electrical circuits	IEC 60757
Cartridge Fuse links for Automobiles	IEC 60127-2
Porcelain (Molded) Fuse links for Automobiles	TBD
Fuses for Automobiles	TBD
Piano key type switches for use in automobiles	TBD
Automobile Lamps	IEC 60598
Electrical Circuits	IEC 60364-1
*as amended from time to time.	

Table: Standards Related to Electric Equipment & Wiring

7 Marking The following information shall be legibly and indelibly marked on a plate permanently affixed on the side of the bus body:

- a) manufacture/body builder's name, address and trade mark;
- b) year of manufacture;
- c) capacity;
- d) serial number;
- e) reference to this standard

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Annex A (informative)

Passenger Capacity

A1 There shall be on the vehicle a number (Ps) of seating places other than folding seats, which conform to this standard. If the vehicle is of class V and IV, the number Ps shall be at least equal to the number of square metres of floor available for passengers and crew (So) rounded down to the nearest whole number; the required number may be reduced by 10% in the case of class V vehicles (0.9So)

A2 The total number of seats N seating and standing in the vehicle shall be calculated such that both of the following conditions are fulfilled:

$$N = p_s + \frac{S_1}{S_{sp}}$$

And
$$N = \frac{MT - MV - L.V - RV_x}{Q}$$

where,

Ps = number of seating places;

S₁ = surface area (m²) available for standing passengers;

S_{sp} = areas summed for one standing passenger (m²/standing passenger);

MT = technically permissible maximum mass

MV = unladen mass (kg) as defined in 2.16.1;

L = specific load of baggage (kg/m²) in the baggage compartment(s);

V = total volume (m³) of the baggage compartments;

R = specific mass of baggage in the roof area (kg/m²);

VX = total surface area (m²) available for baggage to be carried on the roof;

Q = mass (kg) as summed for the load on each passenger seating and standing place, if any. In the case of Class III, vehicles S₁ = 0.

A3 The values of Q, S_{sp}, L and R for every class of vehicle areas follows

Class	Q (kg)	S _{sp} (m ² /standing passengers)	L (kg/m ³)	R (kg/m ²)
II	711)	0.150	100	75
III	711)	(No standing passengers)	100	75

1) Including 3 kg of hand baggage.

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ANNEX B (informative)

(To be submitted by the Vehicle Manufacturer / Body Builder to the Ministry of Works and Transport)

Table: Document History

Test Agency	Vehicle Manufacturer / Body Builder	Document No. (indicating also revision status)
Signature	Signature	
Name	Name	
Designation	Designation	
Date	Date	

Table: Technical Specifications

1.0 Details of Bus Builder/ Manufacturer
1.1 Builder's/ Manufacturer's name & address:
1.2 Telephone No :
1.3 E mail address :
1.4 Contact person :
1.5 Name of model and variants :
1.7 Type and General commercial description (s) :
2.0 Vehicle Chassis Characteristics
2.1 Chassis types approved for Body installation :
2.2 Type of Control (normal control/Full forward control etc.) :
2.3 Wheel base (s) :
2.4 Number of Axles and wheels :
2.5 Chassis (overall drawing) :
2.6 Frame Type :
2.7 Cross sectional view :
2.8 Dimensions: length and width :
2.9 Position and arrangement of engine :
2.10 Dimension (in mm) (Specify drawing reference) :
2.11 Length mm :
2.12 Width mm :
2.13 Height (Unladen) mm :
2.14 Wheel base mm :
2.15 Wheel track mm :
Front :
Rear :
2.16 Body overhang mm :
Front end :
Rear end :

3.0 Body
1.1 Class of Body: (Class I, Class II, Class III, Class IV, Class V & Class VI)
3.3 Dimension drawing and photograph of the vehicle with representative body :
3.4 Range of vehicle dimension (overall) :
3.5 Dimension drawing of the body depicting chassis connecting members :
3.6 Material used for construction :
3.6.1 Structure Material :
3.6.2 Size of sections: (List of sections as per Table 1)
3.7 Method of construction : (Brief construction method)
3.8 Area for Passenger (m ²) :
For seated passengers:
For standing passengers:
3.9 Number of passengers:
Seated :
Standing :
3.10 Number of Passenger seats : (As per Seat Layout)
3.11 Passenger capacity :
Maximum (Including driver) :
Crew (Including driver) :
3.12 Number of Service doors :
3.13 Number of emergency exits :
3.14 Number of escape hatches :
3.15 Volume of luggage compartments (m ³) :
3.16 Area of luggage Transportation on roof (m ²) :
4.0 Clearance
4.1 Minimum road clearance :
4.2 Road clearance from floor :
4.3 Approach angle :
4.4 Departure Angle :
4.5 Ramp-over along :
5.0 Weights
5.1 Vehicle kerb weight kg :
Front axle :
Rear axle :
Total:
5.2 Gross vehicle weight kg :
5.3 Maximum permissible axle weights kg
Front axle
Rear axle
5.4 Reference mass kg :
6.0 Max. stable inclination
Left :
Right :
7.0 Tyres

7.1 No. and arrangement of wheels :
Front :
Rear :
Other :
7.2 Inflation pressure – Unladen :
Front :
Rear :
Other :
7.3 Inflation pressure – Laden :
Front :
Rear :
Other :
8.0 Body Panels
8.1 Outer Panels :
8.1.1 Material :
8.1.2 Thickness :
8.2 Inner Panels :
8.2.1 Material :
8.2.2 Thickness :
8.3 Roof Panels :
8.3.1 Material :
8.3.2 Thickness :
8.4 Floor Panels :
8.4.1 Material :
8.4.2 Thickness :
8.4.3 Type of anti-slip coating :
9.0 Service Doors
9.1 No. of Service Doors :
9.2 Position of Service Doors :
9.3 Dimension of Service Door :
- Front Height :
Width :
- Rear Height :
Width :
- Middle Height :
Width :
10.0 Emergency Exit
10.1 No. of Emergency Doors :
10.2 Position of Emergency Doors :
10.3 Dimension of Emergency Door :
- 1st Height :
Width :
- 2nd Height :
Width :
11.0 Emergency Windows
11.1 No. of Emergency Windows :

11.2 Position of Emergency Windows :
11.3 Area (HxW in sq. m) :
12.0 Escape Hatch
12.1 No. of Emergency Hatches :
12.2 Position of Emergency Hatches :
12.3 Area (HxW in sq. m)
13.0 Steps
13.1 Height of Ist Step :
13.2 Height of Other Steps :
13.3 Depth of steps :
14.0 Floor :
14.1 Floor Height from the ground (unladen):
14.2 Slope of floor :
15.0 Gangway
15.1 Height :
15.2 Width (diameter of gauging device – lower cylinder):
15.3 Width (diameter of gauging device – upper cylinder):
16.0 Handrails & Handholds
16.1 Position (attach dimension layout):
16.2 No. of Handholds:
16.3 Diameter of Handholds:
16.4 Type of anti-slip coating / covering:
17.0 Stepwell Guard:
17.1 Height from the floor:
17.2 Projection from the side wall:
18.0 Passenger Seats:
18.1 Seat Layout:
18.2 Seat width:
18.3 Width of available space for one seating position:
18.4 Height of backrest:
18.5 Width of Armrest:
18.6 Depth of Seat cushion (base):
18.7 Seat Spacing:
18.8 Seat base height:
18.9 Torso angle:
18.10 Seatbase thickness:
18.11 Seat back thickness:
18.12 Clearance space for seated passengers facing partition:
18.13 Free Height over seating position:
19.0 Cabin Luggage Rack:
19.1 Width from side wall:
19.2 Height from Roof:

20.0 Driver Partition:
20.1 Dimension of partition with respect to rear edge of driver seat: (rear most position of driver seat)
21.0 Driver Area:
21.1 Width from the right side wall:
21.2 Distance of driver partition from the driver seat back:
21.3 Distance from H-point to Roof Top:
21.4 Distance between Heel Point and H-Point:
21.5 Distance of H-Point from Floor:
21.6 Distance of lower end of steering wheel from driver seat back:
21.7 Thigh clearance of Steering Wheel:
22.0 External Projections
22.1 Ornaments:
22.2 Projection for head light:
22.3 Radiator grills (Applicable of on external surface):
22.4 Gap between individual elements:
22.5 Radius of curvature of individual element:
22.6 Body Panel (In case of radius of curvature of folds in body panels are less than 2.5 mm the scaled drawing of folds contour and H value:
22.7 Radius of curvature of lateral Rain/Air deflector:
Hinges:
Handles:
23.0 Power Operated Service door
23.1 Make & identification:
23.2 Name of the producer:
23.3 Position of control:
24.0 Automatic Service door
24.1 Make & identification:
24.2 Name of the producer:
24.3 Position of controls:
24.4 Control Circuit (schematic diagram):
25.0 Emergency Door – Warning Device
25.1 Make & identification:
25.2 Name of the producer:
25.3 Position of device:
26.0 Door locks and hinges
26.1 Doors:
26.2 No. of doors:
26.3 Position and type of door:
26.4 Door lock:
26.4.1 Name of manufacturer:
26.4.2 Identification mark:
26.5 Door hinge:

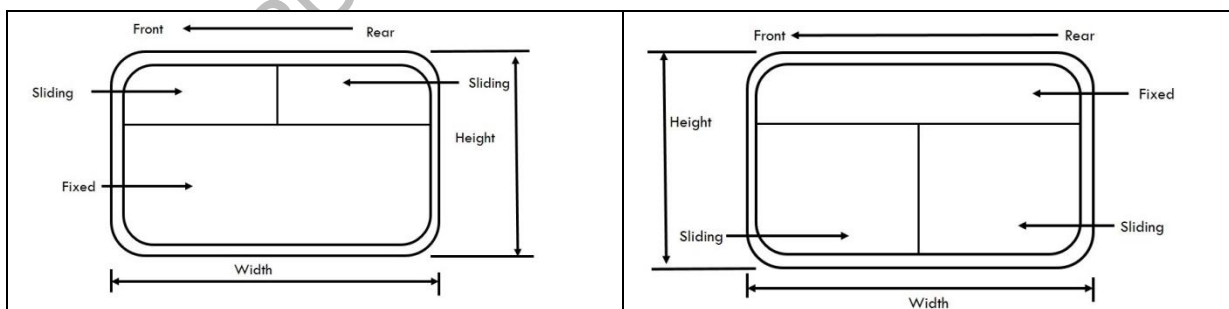
26.5.1 Name of manufacturer:
26.5.2 Identification mark:
27.0 Hood latch
27.1 Name of manufacturer:
27.2 Type:
27.3 Identification mark:
28.0 Safety glass
28.1 Front wind shield (laminated):
28.1.1 Make and identification:
28.1.2 Type (flat/curved, clear/tinted):
28.1.3 Thickness mm:
28.1.4 No. of pieces:
28.1.5 Radius of curvature (If curved):
28.2 Side Windows:
28.2.1 Make and identification:
28.2.2 Type(flat/curved, clear/tinted, toughened):
28.2.3 Thickness mm:
28.2.4 Radius of curvature (If curved):
28.3 Rear Window:
28.3.1 Make and identification:
28.3.2 Type(flat/curved, clear/tinted, toughened):
28.3.3 Thickness mm:
28.3.4 Radius of curvature (If curved):
29.0 Rear view mirror
29.1 Left:
29.1.1 Name of producer:
29.1.2 Type:
29.1.3 Dimension & radius of curvature:
29.2 Right:
29.2.1 Name of producer:
29.2.2 Type:
29.2.3 Dimension & radius of curvature:
29.3 Inside:
29.3.1 Name of producer:
29.3.2 Type:
29.3.3 Dimension & radius of curvature:
29.4 Sketch showing mounting arrangement of mirrors:
30.0 Wind Screen Wiper
30.1 Type:
30.2 No. of wipers:
30.3 Wiper motor:
30.3.1 Name of manufacturer:
30.3.2 Type and identification:
30.3.3 Rated voltage:
30.3.4 Frequency of wiping:

30.4 Wiper arm:
30.4.1 Length :
30.4.2 Manufacturer and Identification :
30.5 Wiper blade:
30.5.1 Length :
30.5.2 Manufacturer and Identification :
30.6 Rubber material :
30.6.1 Type of fixing (as per IS:7827) :
30.6.2 Drawing indicating the seat back angle, seat travel, H point, Rake angle, F dimension And steering wheel position
31.0 Wind Screen Washer
31.1 Name of producer :
31.2 Type :
31.3 Number of nozzles :
31.4 Spray Area :
32 Equipment for occupant's safety
32.1 Driver Seat belt :
32.1.1 Name of producer :
32.1.2 Type :
32.1.3 Number :
32.2 Driver Seat belt anchorage :
32.2.1 Name of producer :
32.2.2 Type :
32.2.3 Number :
32.3 Head restraint :
32.3.1 Name of producer :
32.3.2 Type :
32.4 Passenger Seat :
32.4.1 Name of producer :
32.4.2 Type :
32.4.3 Frame structure Material :
32.4.4 Section size:
32.4.5 Pad material :
32.4.6 Upholstery :
33.0 Bumper
33.1 Size :
Front :
Rear :
33.2 Projection :
33.3 Clearance between bumper & body :
34.0 Fuel filler
34.1 Aperture :
34.2 Position :

35.0 Fire Extinguisher
35.1 Number :
35.2 Type :
35.3 Capacity :
35.4 Name of Producer :
36.0 First Aid Equipment
36.1 Number :
36.2 Contents :
37.0 Towing devices
37.1 Type :
37.2 Name of manufacturer :
37.3 Capacity :
38.0 Number Plate lamp
38.1 Name of producer :
38.2 Type and Identification :
38.3 Number and colour :
39.0 Tail lamp
39.1 Name of producer :
39.2 Type and Identification :
39.3 Number and colour :
40.0 Parking lamp
40.1 Front :
40.1.1 Name of producer :
40.1.2 Type and Identification :
40.1.3 Number and colour :
40.2 Rear :
40.2.1 Name of producer :
40.2.2 Type and Identification :
40.2.3 Number and colour :
41.0 Stop lamp
41.1 Name of producer :
41.2 Type and Identification :
41.3 Number and colour :
42.0 Reversing lamp
42.1 Name of producer :
42.2 Type and Identification :
42.3 Number and colour :
43.0 Direction indicator
43.1 Front :
43.1.1 Name of producer :
43.1.2 Type and Identification :

43.1.3 Number and colour :
43.2 Rear :
43.2.1 Name of producer :
43.2.2 Type and Identification :
43.2.3 Number and colour :
43.3 Side :
43.3.1 Name of producer :
43.3.2 Type and Identification :
43.3.3 Number and colour :
43.3.4 Type of flasher :
44.0 Emergency signalling equipment
44.1 Front :
44.1.1 Name of producer :
44.1.2 Type and Identification :
44.1.3 Number and colour :
44.2 Rear :
44.2.1 Name of producer :
44.2.2 Type and Identification :
44.2.3 Number and colour :
44.3 Side :
44.3.1 Name of producer :
44.3.2 Type and Identification :
44.3.3 Number and colour :
45.0 Reflector
45.1 Front :
45.1.1 Name of producer :
45.1.2 Type and Identification :
45.1.3 Number and colour :
45.1.4 Area :
45.2 Rear :
45.2.1 Name of producer :
45.2.2 Type and Identification :
45.2.3 Number and colour :
45.2.4 Area :
45.3 Side :
45.3.1 Name of producer :
45.3.2 Type and Identification :
45.3.3 Number and colour :
44.3.4 Area :
46.0 Top light
46.1 Name of producer :
46.2 Type and Identification :
46.3 Number and colour :
47.0 Internal Lighting & Illumination
47.1 Driver Cab lighting :

47.1.1 Type :
47.1.2 Name of producer :
47.1.3 Number :
47.1.4 illumination intensity :
47.2 Passenger Compartment Lighting
47.2.1 Type :
47.2.2 Name of producer :
47.2.3 Number :
47.2.4 Illumination intensity :
47.3 Other Area Lighting
47.3.1 Type :
47.3.2 Name of producer :
47.3.3 Number :
47.3.4 Illumination intensity :
48.0 Electrical Circuit
48.1 Circuit Diagram (attach details):
49.0 Electrical Cables
49.1 Name of producer :
49.2 Conductor Cross section :
49.3 Insulation Class :
50.0 Fuse
50.1 Type & Make :
50.2 Name of producer :
51.0 Master switch for Electrical :
51.1 Type & Make :
51.2 Name of producer :



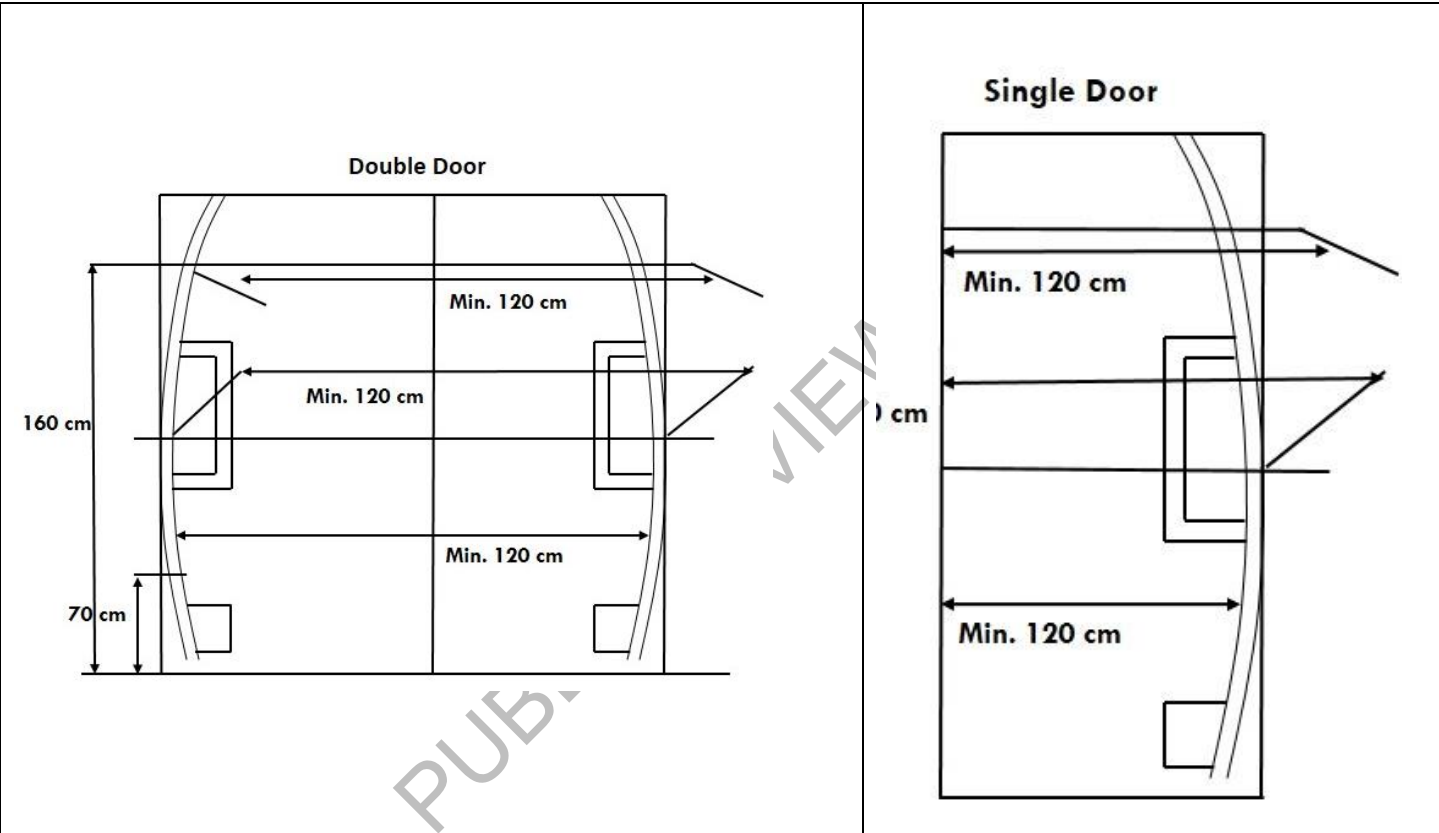
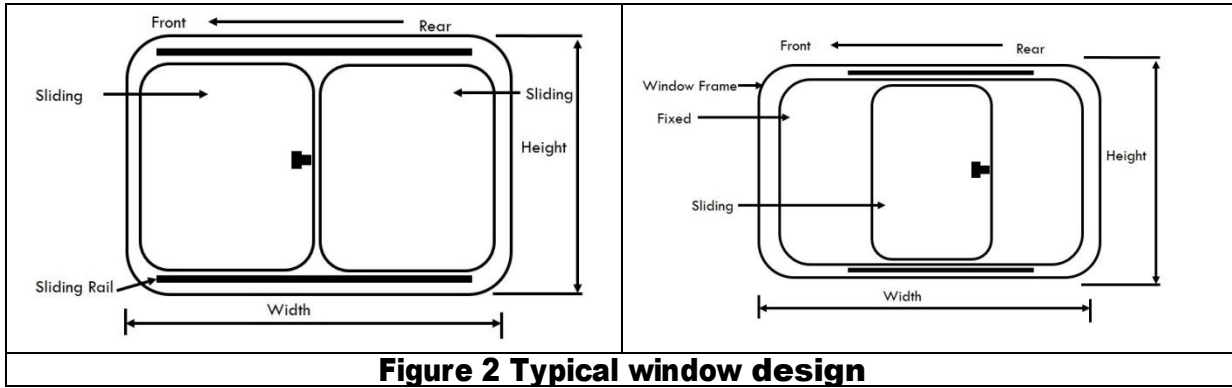
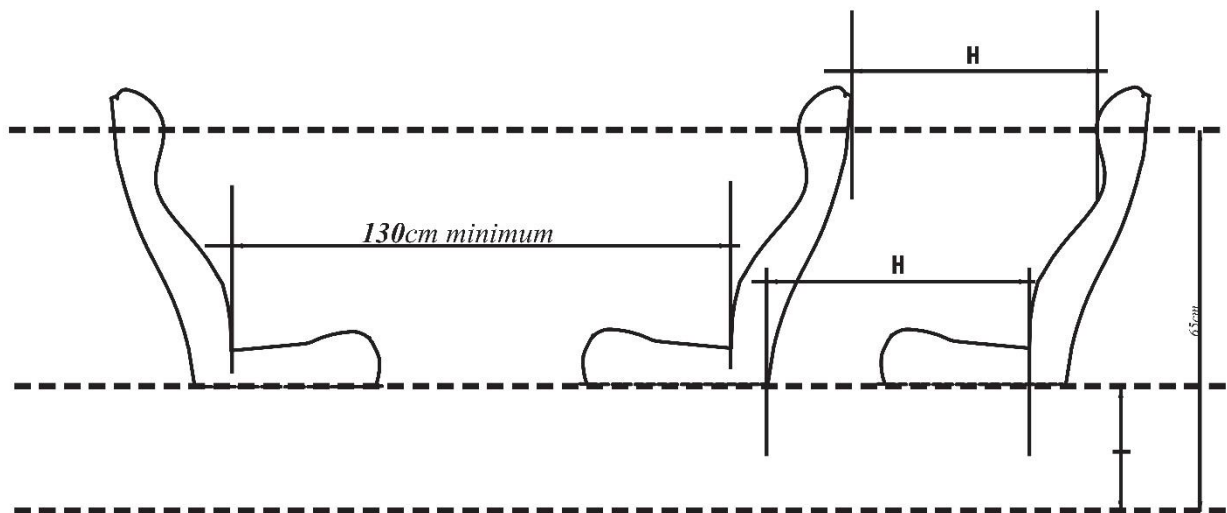
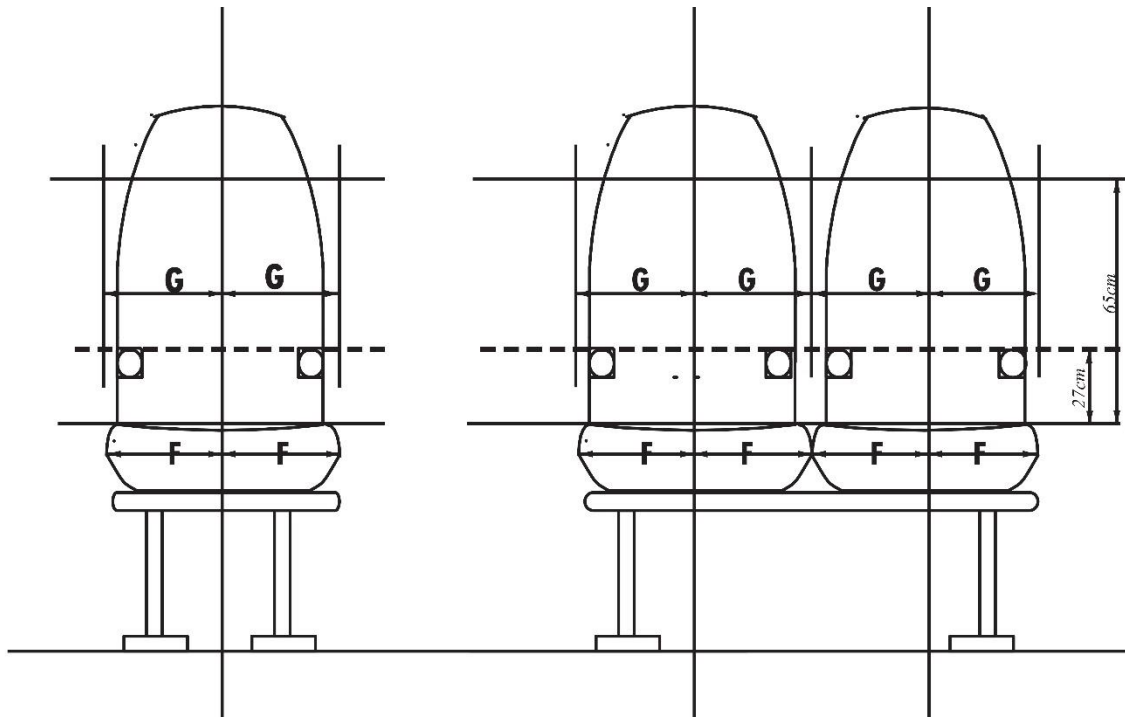
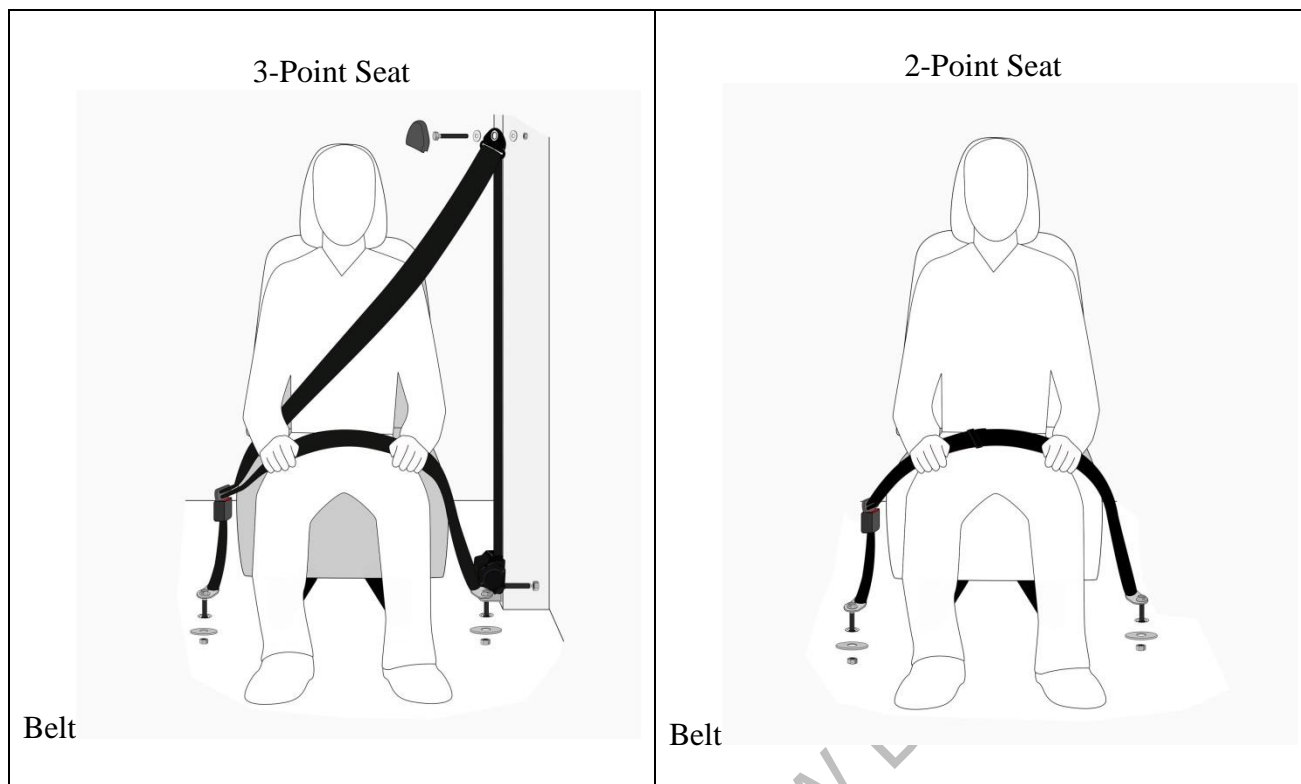


Figure 1: Doors





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- [2] AIS – 052 Code of Practice for Bus Body Design and Approval
- [3] CIDECT Design Guide 7 ,for fabrication, Assembly and erection of Hallow section structures
- [4] CIDECT Design Guide 8, for circular and rectangular Hallow section welded joints under fatigue loading

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