सत्यमेव जयते

Ministry of Urban Development
Government of India

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April, 2013

Recommendatory

Urban Bus Specifications – II

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कमल नाथ

Kamal Nath

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मंत्री

शहरी विकास

भारत सरकार

Minister of Urban Development

Government of India

MESSAGE

Urban transport has increasingly played a key role in making rapidly growing cities livable and sustainable. Sensitivity to local context and scientific evaluation of available alternatives lies at the core of an efficient public transport system. At the same time, the soft aspects like access to information, experience of journey and customer satisfaction play an important role in attracting and retaining users to the system. A proactive branding and communications plan adds significantly to the system image.

As we approach the second phase of JnNURM, the Ministry of Urban Development continues to make constant efforts to push the reforms agenda and delivery of urban infrastructure. One such initiative is to revisit the **Urban Bus Specifications** (introduced in JnNURM – I) to help cities procure and run modern city buses. This document – **"Urban Bus Specifications – II"** lays out standards for cities to base their choice from a definite set of options for streamlining bus operations. The specifications also include those for buses for BRTS (Bus Rapid Transit Systems) as more and more cities embrace the concept, underpinning the need for standardization.

The specifications are prepared in consultation with the industry, academia and state transport undertakings. I congratulate the Urban Bus Committee for successfully creating these standards that are bound to bridge the gap between user expectations and the bus services.

(Kamal Nath)

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FOREWORD

India's urban population is going to nearly double by 2030. This comes as a challenge to cities that are already facing acute shortage of quality urban transport. To ease this situation and move towards creation of sustainable infrastructure, Govt. of India launched JnNURM in 2005. Acknowledging that urban transport was a key sector that needed significant interventions, the National Urban Transport Policy (NUTP) was introduced in 2006 to guide the efforts by cities towards sustainable transportation systems and urban development. The policy very clearly stated that the focus is to promote movement of people over vehicles, and recommended good quality public transport in medium and large cities.

The current investments in public transport, especially city bus services are far from adequate to meet the emerging demand. The High Powered Expert Committee on Urban Infrastructure and the MoUD estimated that cities in India need about 1.5 lakh buses amounting to approximately Rs. 60,000 crores in the next 20 years. The report further cites that only 20 of 85 cities with over 0.5 million population (2009) offer a organised city bus service. The recommendations of the Working Group on Urban Transport for 12th Five Year Plan include introduction of organized public transport in all 2 lakh+ population cities and state capitals, as one of its goals. The report asserts that city bus services have been and will continue to be the major mode of public transport in Indian cities. It was recommended that the buses be procured as per urban bus specifications and managed by a special purpose vehicle. The service level benchmarks for urban transport also direct that the fleet meets urban bus specifications.

The Ministry of Urban Development introduced Urban Bus Specifications in 2008 in view of the increased need for funding and guidance to cities in procurement of city buses. Under the 2nd economic stimulus package of the Government of India, 61 cities procured about 13400 buses under JnNURM and in the process and brought forth some lacunae and gaps in the urban bus specifications.

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The Ministry of Urban Development reached out to various stakeholders to identify potential issues to be resolved for going forward and found that cities were operating very different types of buses across the country. These buses were often retrofitted to accommodate modern technology (IT systems). The development of prototypes as per city's specifications took a long time, thus delaying procurement. Most cities did not follow any standardized maintenance manuals and codes of practice. A key learning was that inadequate detailing of specifications created complexities in tendering process that cities were not prepared for.

In an attempt to address these issues and facilitate the process of bus procurement in anticipation of next round of funding under JnNURM-2, MoUD constituted an Urban Bus Committee in March, 2012. The committee worked towards revising the existing urban bus specifications to achieve uniformity in the bus manufacturing industry with minimal variants for a city to choose from. Additional objectives included consideration for driver and passenger comfort, enhanced safety, universal design, in-built ITS technology etc. The specifications also incorporate desired standards for reduced pollution and improved fuel efficiency. New variants to attract premier customers and specialised buses for BRTS have been introduced.

These specifications are applicable to buses for urban operation defined as a vehicle intended for operations within the confines of a city or a greater metropolitan area. Such operations are associated with frequent stops/starts and the bus for urban bus operations is designed and constructed accordingly with space for standing passengers. It is intended that the specifications contained in this document will apply to all urban bus services in the country irrespective of their sources of funding. The anticipated benefits of this publication are:

- Attracting choice riders to use public transport including people with disabilities
- Better working environment for drivers
- Driver training and introducing customer care & complaints redressal system
- Focus on R&D to improve product quality to meet stringent safety tests
- Bringing efficiencies in the operations and maintenance practices
- Leveraging benefits of contractual bidding for procurement process

I encourage all STUs/transport authorities/SPVs/operators and other organizations associated with urban transport to use these standards and to facilitate comfortable, affordable, safe and reliable public transport system in cities.

Dated: April, 2013

(Dr. Sudhir Krishna)

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PREFACE

The National Urban Transport Policy (NUTP), 2006, outlines the need to create and maintain safe, affordable, rapid, comfortable, reliable and accessible public transport in cities in India. In the discussion of available technologies for achieving sustainable public transport, the policy advocates bus based systems. However, it was soon realized that the city buses in India suffer from a poor brand image, low on passengers, not ITS enabled and poor on ergonomics. Taking cognizance of the need to focus on comfort, safety, reliability and efficiency of bus based public transport system in urban areas; Ministry of Urban Development (MoUD) recommended "Specifications for Urban Buses in 2008 for the first time in India.

While approving the funding for purchase of urban buses for the mission cities under JnNURM, the urban bus specifications were made mandatory. Consequently, these specifications facilitated the procurement of more than 13400 ITS enabled modern buses across 61 cities in India, thereby changing the landscape of bus based public transport in the country. Today these specifications have been widely accepted within the industry.

MoUD received invaluable feedback from stakeholders on the urban bus specifications. Some of the key learning were: the need to reduce number of variants through greater degree of standardization; ITS specifications should be integral to the bus specifications; greater focus on driver as well as passenger comfort; more detailing of specifications and need for separate specifications for BRT buses as well as premium category buses.

With a view to synthesize the above learning and provide further impetus to a responsive bus based public transport systems in urban areas there was a need to revise the urban bus specifications. Accordingly, MoUD on March 14, 2012 constituted a Committee to revise the urban bus specifications. The objectives of the Committee for revision of the urban bus specifications were:

- Focus on the comfort and ride quality for passengers and drivers
- Enhanced safety features including accessible for persons with disability
- Standardisation of bus features
- Adoption of cutting edge technology integrated with ITS
- Reduction in bus feature variants
- Improved fuel efficiency
- Separate specifications for buses for BRT operations
- Introduction of new variants- premium, articulated and bi-articulated buses

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Special emphasis has been given to the safety of the women passengers while deciding the specifications. Features like wider windows, lighting, CCTV cameras, inner signage displaying helpline number, 'foot operated micro pedal switch for emergency' to communicate to control room, two way communication of driver with control room and automatic vehicle location system (AVL) have been added as part of UBS-II. Moreover, features like 'manual ramp' & 'exclusive space' for wheel chair, 'buzzer for stop request' will make these buses more accessible for passengers with disability.

The Committee comprised members from (i) M/o Road Transport & Highways, (ii) D/o Heavy Industries, (iii) Delhi Transport Corporation (DTC), (iv) Bureau of Police Research and Development (BPR&D), (v) Bangalore Metropolitan Transport Corporation (BMTC), (vi) Society of Indian Automobile Manufacturers (SIAM), (vii) Association of State Road Transport Undertakings (ASTRU), (viii) Indian Association of Bus Manufacturers (IABM), (ix) Automotive Research Association of India (ARAI), (x) Central Institute of Road Transport (CIRT), (xi) Institute of Urban Transport (IUT) (xii) Urban Mass Transit Company (UMTC) and (xiii) Centre of Excellence CEPT, Ahmedabad. The Committee also set up Core Group to assist the Committee in researching and drafting the specifications in consultation with industry experts, bus manufacturers, vendors, suppliers etc.

The Committee, cognizant of the lead time, required to implement advancements in bus technology and the related development costs has prepared a road map for upgrading of specifications. The revised urban bus specifications have identified certain technology advancements which will come into effect from April 1, 2015. The advantage of such a road map is that it obviates the need for frequent revision of the standards and specifications and helps bus manufacturers to focus their R&D activities in a pre-charted direction.

National level stakeholders consultations on the draft revised specifications were held on 7th September, 2012 at Ahmedabad and on 1st October, 2012 at New Delhi and after considering the suggestions, feedback and inputs from various stakeholders the Committee has finalized the **Urban Bus Specifications II.**

This exercise is a collective work of representatives from various Ministries, Automobile Industry, ITS Manufacturers, Research Institutes, Associations and Experts. I sincerely thank all the members of "Urban Bus Committee" and "Core Group", especially Mr. Ajai Mathur & Mr. Laghu Parashar from UMTC Ltd, Prof. Shivanand Swamy & Prof. Manjiri Akalkotkar from CoE, CEPT University and Mr. A.S. Lakra, former Director, CIRT, Pune for their in-depth involvement throughout this exercise. I am also thankful to officials from various State Governments for giving their valuable suggestions during stakeholders workshops. I am grateful for the support and guidance received from Dr. Sudhir Krishna, Secretary, Ministry of Urban Development, Government of India who has also been instrumental in supporting at all steps. I am also grateful to Shri Kamal Nath, Hon'ble Minister for Urban Development for providing the vision and leadership in changing the face of urban transport in India. I strongly believe that these specifications for urban buses will give a fillip to our endeavor to transform the urban transport scenario in the country so that public transport can be marketed as a 'Branded product' and public transport becomes a preferred and safe mode of transport for all.

Dated: April, 2013 **(S. K. Lohia)**

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Table of Content

Abbreviations (Used in Bus Specifications)

ABS	Acrylonitrile Butedienestyrene
ABS	Anti skid anti brake locking system
A.C.	Air Conditioned
ACX	Air Conditioned Deluxe
AIS	Automotive Industry Standards
AIS052	Code of Practice for Bus Body Design and Approval (Revision 1): 2008
ASTM	American Standard for Testing of Materials
BIS	Bureau of Indian Standards
BRTS	Bus Rapid Transit System
BS	Bharat Stage
C/L	Centre Line
CCTV	Closed Circuit Television
CLC	Cabin Luggage Carrier
CMVR	Central Motor Vehicle Rules
CNG	Compressed Natural Gas
dbA	Decibels on scale A
DC	Direct Current
DIN	German Standards
EBS	Electronic Braking control System
ECAS	Electronically Controlled Air Suspension
ELR	Emergency Locking Retractors
EMS	Electronic Engine Management System
ERW	Electric Resistance Welding
g	gram
gms/cc	grams per cubic centimetre
GSR	General Statutory Rules

GVW	Gross Vehicle Weight
HP	Horse Power
Ht.	Height
Hz	Hertz
ICE	Internal Combustion Engine
IS	Indian Standards
ISO	International Organization for Standardization
ITS	Intelligent Transport System
JASO	Japanese Automotive Standards Organization
Kg/m3	kilogram per cubic metre
Kg	Kilogram
Km	Kilometers
Kmph	Kilometres per hour
Kmpkg	Kilometre per kilogram
Kmpl	kilometre per litre
LDPE	Low Density Poly-ethylene
lux	unit of illumination
m/s	metre per second
MDI	Methylene Diphenyl Di-isocyanate
mm	millimetre
NBS	National Bureau of Standards
NDX	Non Deluxe
NVH	Noise Vibration and Harshness
^{o}C	degree Celsius
pax	Passenger
PPLD	Poly Propylene Low Density

Abbreviations (Used in I.T.S. Specifications)

PU	Poly Urethane
PVB	Polyvinyl butyryal
PVC	Poly Vinyl Chloride
PwD	People with Disability
RE bus	Rear Engine bus
RMS	Root Mean Square
rpm	Revolutions per Minute
SAE	Society of Automotive Engineers
SPV	Special Purpose Vehicle
Sq.mm	Square millimetre
STU	State Transport Undertaking
ULSD	Ultra-Low-Sulphur diesel
VM	Vehicle Manufacturer
2G	Second Generation
3G	Third Generations
AIS	Automotive Industry Standard
AMPS	Advanced Mobile Phone System
API	Application Programming Interface
ARAI	Automotive Research Association of India
AV	Audio-Video
AVI	Audio Video Interleave
AVL	Automatic Vehicle location System
BDC	Bus Driver Console
BIS	Bureau of Indian Standards
Bit	Binary digit
BRTS	Bus Rapid Transit System
CAN	Controller Area Network.
CCC	Central Control Centre
CCD	Charge Coupled Device

CIRT	Central Institute for Road Transport
CMVR	Central Motor Vehicles Rules
COP	Conformity of Production
CPU	Central Processing Unit
dBm	Power ratio in decibels
DC	Direct Current
DCS	Digital Cellular Service
^{o}C	degree Celsius
DTC	Diagnostic Trouble Code
DVI	Digital Visual Interface
DVR	Digital Video Recording
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMC	Electro Magnetic Compatibility
FME (F)	For Mobile Equipment Female
FPS	Frames per Second
GB	Giga Byte
GPGGA	Global Positioning System Fix Data
GPGSA	Global Positioning Overall Satellite data
GPGSV	Global Positioning Satellites in view
GPIO	General Purpose Input Output
GPRMC	Global Positioning Recommended Minimum Data
GPRS	General Packet Radio Service
GPS	Global Positioning System
GPVTG	Global Positioning Vector track and Speed over the Ground
GSM	Global System for Mobile Communications
HDMI	High-Definition Multimedia Interface
Hz	Hertz
IEC	International Electro technical Commission
IEEE	The Institute of Electrical and Electronics Engineers

Abbreviations (Used in I.T.S. Specifications)

IP	Ingress Protection
IP	Internet Protocol
IR	Infra Red
ISI	Indian Standards Institute
ISM	Industrial Scientific and Medical
ISO	International Organization for Standardization
ITS	Intelligent Transport System
Kb	Kilobit
LAN	Local Area Network
LAT	Latitude
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LONG	Longitude
ma	Milliamps
MB	Mega Byte
mCd	milli Candela
MoUD	Ministry of Urban Development
NAT	Network Address Translation
NDA	Non-Disclosure Agreement
nm	Newton Meter
NMEA	National Marine Electronics Association
OBITS	On Bus Intelligent Transport System
OEM	Original Equipment Manufacturer
PA	Public Announcement System
PAL	Phase Alternating Line
PCB	Printed Circuit Board
PCS	Personal Communications Service
PGN	Parameter Group Number

PID	Parameter Identifier
PIS	Passenger Information System
PLCC	Plastic Leaded Chip Carrier
PWD	Person with Disability
PWM	Pulse Width Modulation
RAM	Random Access Memory
RHCP	Right Hand Circular Polarization
RMS	Root Mean Square
RPM	Revolutions Per Minute
SCN	Security Camera Network System
SCU	Single Control Unit
SMA (M) ST	Sub Miniature version A Male Straight
SMT	Surface Mount Technology
SPN	Standardized Message name,
TA	Type Approval
TCP/IP	Transmission Control Protocol/Internet Protocol
TCP	Transmission Control Protocol
TFT	Thin film transistor
Typ	Typical
UBS	Urban Bus Specification
UMTS	Universal Mobile Telecommunications System
UV	Ultraviolet
VGA	Video Graphics Array
VHMD	Vehicle Health Monitoring and Diagnostics
VSWR	Voltage Standing Wave Ratio
WLAN	Wireless Local Area Network
XML	Extensible Markup Language
SD	Secure Digital

Chapter - 01

Scope, Purpose and Definitions

Scope & Purpose

With introduction of the National Urban Transport Policy (NUTP) in April 2006, the Government of India endorsed the idea that it's essential for the country to work towards building of sustainable transport infrastructure. The policy outlines the need to create and maintain safe, affordable, rapid, comfortable, reliable and accessible public transport in cities in India. In the discussion of available technologies for achieving sustainable public transport, the policy promulgates bus based systems. It was also realized that the bus based public transport systems are operating in various arrangements in different cities and lack any kind of standardization.

The Ministry of Urban Development (MOUD) recognized the need and introduced specifications for urban buses in 2008. Based on this experience, the Ministry took feedback from various stakeholders and formulated an 'Urban Bus Committee" in March 2012 to address these issues. The committee revised urban bus specifications to achieve uniformity in the bus manufacturing industry with minimal variants.

The Ministry of Urban Development, Government of India hereby formulates the following specifications and standards that have to be complied with by the relevant category of buses used in urban bus services:

1. Standard bus -(A/C and Non AC)
2. Mini bus-(A/C and Non AC)
3. Midi bus -(A/C and Non AC)
4. Premium Standard Bus Segment –A/C
5. Premium Midi Bus Segment –A/C
6. Bus Rapid Transit System
    a. 12 m standard BRT bus
    b. 18 m articulation BRT bus for guidance only
    c. 24 m Bi-articulated BRT bus for guidance only
    d. Mini Bus
    e. Midi Bus
7. Intelligent Transport System (I.T.S)

These specifications are applicable to the buses for urban operation means “a vehicle intended for operations within the confines of a city or a greater metropolitan area. Such operations are associated with frequent stops/starts and the bus for urban bus operations is designed and constructed accordingly with space for standing passengers".

This document aims to enhance the attractiveness of buses used to provide urban services in order to encourage increased usage, with a particular emphasis on improving accessibility for all users, including people with physical, sensory and cognitive impairments.

Definitions

Unless otherwise specified, definitions of terms used in this document shall be as per AIS-052, Code of Practice for Bus Body Design and Approval or The Central Motor Vehicles Rules (CMVR), 1989, as applicable.

Chapter - 02

Specifications for Standard size bus

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
	Definition of Low Floor area	Low floor area shall not be less than 50% of the total saloon area (excluding front wheel boxes and driver's cab) and shall not be ramped in the longitudinal plane
1	Propulsion system	ICE, electrical, hybrid, fuel cell
2	Fuel-options	Fuel to be compatible with propulsion system & prescribed emission norms
3	Engine	
3.1	Engine HP sufficient to provide:	
a	Rated performance at GVW in a stop/start urban operations	Geared maximum speed without speed limiter to be 75 kmph
b	Acceleration (metre/sec^2)	≥ 0.8
c	Attain bus speed of 0-30 kmph in seconds	≤ 10.5
d	Maximum speed	Geared maximum speed without speed limiter to be 75 kmph
e	Grade ability from stop at GVW	17%
f	Rated HP/torque preferably at lower rpm range	Maximum engine torque required at lower range of RPM and spread over a wider range of RPM
g	Power requirements for Air conditioning system, ITS etc	Required
3.2	Emission norms	BS III/BS IV or latest as applicable
3.3	Engine management	Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, diagnostic details message (engine specific)
3.4	Engine operational requirements	Engine should be able to operate efficiently at ambient temperatures of approximately 0° to 50° C, humidity level from 5% to 100%, and altitude levels of up to 2000 meters, generally operating in the semi arid zone/hilly region prevailing in the area.

[1] Cities having population ≤ 1 million (as per census 2011) can procure buses having 900 mm floor height also whereas cities having population more than 1 million (as per census 2011) will procure either 650mm or 400mm floor height buses. Any change in composition is subject to approval of Ministry of Urban Development (MOUD), GOI. W.E.F. 1.4.2016, 900mm floor height standard size buses are to be procured only as an exception in all cities ≤ 1 million populations also.

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
3.5	Engine location	Optional
3.6	Transmission	Purchaser to select any one transmission system. However, rear engine buses to have either automatic or automated manual transmission system only. (any bus delivered after 1st April, 2015 will mandatorily have either automatic or automated manual transmission system)
a	Automatic with torque convertor. Neutral during stops	
b	Automated manual	
c	Manual - synchromesh - forward speeds (minimum 5) & constant mesh on reverse gear	
4	Operational safety	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)
5	Clutch (where applicable)	Dry, single plate, power assisted operation
5.1	Rear axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations
5.2	Front axle	Heavy duty reverse Elliot type axle suitable for various floor heights
6	Steering system	Hydraulic power steering with height and angle adjustment
7	Suspension system[2]	Pneumatic
7.1	Front	Air bellows - 2 numbers
7.2	Rear	Air bellows – 2/4 numbers
7.3	Kneeling applicable in case of air suspension (required only for 400 mm floor height buses)	60 mm entry/exit side severally & collectively
7.4	Anti roll bars/stabilizers[3]	Both front and rear
7.5	Shock absorbers	Hydraulic double acting 2 at front & 2/4 at rear

[2] Only in case of 900 mm floor height buses, front suspension can have option of air suspension/independent/parabolic/weveller type. Irrespective of the type of suspension, floor level of bus should not go beyond maximum floor height. Any bus delivered after 1st April, 2015 will mandatorily have air suspension or superior in both front & rear.

[3] Optional in case of independent suspension

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
7.6	Controls (optional)	Electronically controlled air suspension system
8	Braking system	Dual circuit full air brakes, with preferably disc type arrangement for front and drum at rear brakes. Graduated hand controlled, spring actuated parking brakes acting on rear wheels (any bus delivered after 1st April, 2015 will mandatorily have disc brake in front)
8.1	Anti skid anti brake locking system (ABS)	As per CMVR
8.2	Electronic controls	Optional
9	Electrical system	24 volt DC
9.1	Batteries:	Low maintenance type lead acid batteries for 24 V system- performance as per BIS:14257-1995 (latest). 2*12V of commensurate capacity. Maintenance free batteries preferred.
9.2	Self starter	24V
9.3	Alternator	24V (another alternator of similar capacity for AC buses)
9.4	Electrical wiring & controls- type	As specified separately under ITS specifications
10	Speed limiting device (optional):	Electronic type duly approved /certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit
11	Tyres	Steel radial tube-less. Size and performance as per CMVR
12	Fuel tank	Capable to enable bus operation ≥ 300 km between consecutive fillings
	Fuel tank location	Optional
13	Bus characteristics	
13.1	Bus dimensions (mm)	
a	Overall length (over body excluding bumper)	12000 (minus tolerance of 100)
b	Overall width (sole bar/floor level- extreme points)	2600 (maximum)
c	Overall height (unladen - at extreme point)	3800 (maximum)
d	Wheel-base	6100 (tolerance -200 +400)

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
i	Front overhang	As per CMVR
ii	Rear overhang	As per CMVR
13.2	Maximum turning circle radius (mm)	As per CMVR
13.3	Floor height above ground (mm)- maximum	400/650/900
13.4	Clearances (mm)	
a	Minimum axle clearance (mm)	190
b	Wheel area clearance (mm)	> 220 for parts fixed to bus body & > 170 for the parts moving vertically with axle.
c	Minimum ground clearance (un-kneeled) in mm at GVW	Within the wheelbase not less than 240
13.5	Angles (degrees)	
a	Angle of approach (unladen)	Not less than 8.5°
b	Angle of departure (unladen)	Not less than 9.0°
c	Ramp over angle (half of break-over angle)	Not less than 4.8°
14	Bus gates/Doors	
14.1	Type of doors	Preferably in-swing in front with option of jack knife and double jack knife in rear door
a	Operating mechanism	Electro pneumatically controlled
b	Opening/Closing time in seconds per operation (maximum)	4
c	Positions of door controls	On dashboard and also inside & outside of doors
d	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory
14.2	Front service doors - (near side/non-driver side)	√
a	Minimum door aperture (without flaps) in mm	800
b	Minimum clear door width (fully opened) in m	650 ± 50

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
c	Minimum door height in mm	1900
d	Positioning front service gate	Ahead of front axle
e	Number of gates	1
14.3	Rear service doors (near side/non-driver side) :	
14.3.1	Rear service doors (near side):	√
a	Minimum door aperture (without flaps) in mm	1200
b	Minimum clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Positioning rear door	Purchaser to select any of the two options
i	Ahead of centre line of rear axle	Preferably rear edge of gate 1500 mm ahead of centre line of rear axle
ii	Behind the centre line of rear axle	Preferably front edge of gate 1500 mm behind centre line of rear axle
e	Number of gates	1
14.3.2	Applicable for BRTS	
14.4	Applicable for BRTS	
14.4.1	Applicable for BRTS	
14.4.2	Applicable for BRTS	
14.4.3	Applicable for BRTS	
14.5	Applicable for BRTS	
14.6	Maximum first step height (mm) from ground - unladen & un-kneeled position in buses with:	
a	Stepped type entry (maximum)	400
b	Level entry (at station platform height)	Applicable for BRTS
14.7	Maximum height (mm) of other steps	

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
a	if door ahead of rear axle	250 (applicable only for 900/650 mm floor ht. buses)
b	if door behind rear axle	300 (applicable only for 900/650 mm floor ht. buses)
14.8	Ramp for wheel chair at the gates wherever required	Sunken type wrap over (manually operated) ramp, for wheel chair of PwDs, fitted on floor at gate in front of PwD seat anchorage. Suitable design mechanism for 650/900mm floor height considering that floor level of bus stops are at 400mm
a	Dimensions	Minimum width 900 mm
b	Material	Aluminium alloy with anti-slip coating
c	Load carrying capacity (in kilograms)	> 300
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200 mm	√
e	Device to lock wrapped up ramp	√
f	Kneel ramp control: (applicable in reference of clause 7.3)	Kneeling arrangement for kneeling on left side severally and combined. Kneeling up to 60mm
g	Requirement for passengers with limited mobility	√
i	Wheel chair anchoring - minimum for one wheel chair	√
ii	Priority seats - minimum 2 seats	√
iii	Stop request	√
h	Emergency doors/exits or apertures (Numbers)	As per AIS 052
	Dimensions in mm	As per AIS 052
i	Door closing requirements for bus movement -	Bus could move only after door closing completed
i	Power operated service door - construction & control system of a power operated service door to be such that a Passenger is unlikely to be injured/trapped between the doors while	As per AIS 052

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
	closing.	
ii	Door components	As per AIS 052
iii	Door locks/locking systems/door retention items	As per AIS 052
iv	Door hinges	As per AIS 052
15	Bus body	
15.1	Design type approval	As per Annexure-3
15.2	Bus structure - materials specs etc	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3
15.3	Insulation	
a	Roof structure	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3
b	Engine compartment	
15.4	Aluminium extruded sections for:	
a	Rub rail	Aluminium extrusion IS 733/1983 or better
b	Decorative moulding	
c	Wire cover	
d	Wearing strip	
e	Foot step edging	
f	Panel beading	

	Bus specifications of standard size urban bus (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height: 400/650/900[1] mm	
g	Window frame		
h	Roof grab rail brackets		
15.5	Floor type/Materials etc		
a	Type of floor	Flat except at wheel arches in the low floor area of bus- seats may be located over the wheel arches	
b	Applicable for BRTS		
c	Steps on floor	No steps except those necessary for the rear high floor area	One step in the low floor area either at gates or across the floor. Steps may be provided as necessary on high floor in the rear side
d	Applicable for BRTS		
e	Maximum floor slope	6%	
f	Floor surface material	12 mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513 (Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000 (IS15061:2002)	
g	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy	
15.6	Safety glasses and fittings:		
a	Front windscreen (laminated) glass:	Single piece laminated safety glass, plain, flat/curved with curved corners with PVB film IS 2553 (Part-2)-1992/latest. Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
b	Rear windscreen: (wherever provided)	Single piece flat/curved toughened glass-plain/flat/curved at centre &	

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
		curved at corners IS:2553 (Part-2)–1992/latest
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)
c	Side windows:	Flat, 2-piece design-top fixed/sliding & bottom sliding toughened glass IS2553 (Part-2)-1992/latest
d	Glass specifications	Toughened glass IS2553(Part-2)-1992/latest
	Glass thickness:	4.8-5.3mm
e	Window & other glasses - material specs, thickness etc	Toughened as per IS:2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness
f	Safety glass	As per AIS 052/CMVR
g	Rear view mirrors	As per AIS 052
15.7	Seating and gangway etc	
15.7.1	Passenger seating's for ordinary type-1 buses	As per AIS 052
a	Seat layout in the low floor area	2x2
b	Seat layout in the higher floor area	2x2
c	Seat area/seat space per passenger (width*depth) mm	400*350
d	Seat pitch - minimum (mm)	As per AIS 052
e	Minimum backrest height-from floor to top of seat/ headrest	As per AIS 052
	Seat base height-distance from floor to horizontal front upper surface of seat cushion mm.	As per AIS 052
	Seat back rest height (mm)	375
f	Torso angle (degrees)	Minimum 12°
g	Seat materials	'PPLD/LDPE'moulded AIS 023 & AIS 052 for performance
h	Seat frame structure material where required:	Frame structure of ERW steel tube
i	Free height over seating position (mm)	More than 900

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
	Seat base height	As per AIS 052
j	Clearance space for seated Passenger facing partition (mm)	Minimum 350
k	Seat back/Pad material/Thickness:	Polyurethane foam IS15061:2002 (padding is optional)
	Type:	MDI moulded IS 5509
	Upholstery:	Pile fabric/jekard 0.7-1mm thickness
l	Area for seated passengers (sq. mm.) type 1 NDX/SDX:	400*350
m	Area for standee passengers (sq. mm.)	As per AIS 052
n	Number of seats including one for wheel chair	32 - 34
o	Number of standees	Calculation as per AIS 052
p	Sitting/Standing ratio	Not required
q	Head rest	Not required
r	Seats side facing location	Not suggested except on wheel arches
s	Seat arm	Not required
t	Magazine pouch	Not required
u	Individual seat row fans	Not required
v	Reading lights	Not required
w	Seat back rest	Fixed
x	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
y	Performance & strength requirements of:	√
i	Driver seat	As per AIS 023
ii	Passenger seats	As per AIS 023
15.7.2	Gangway:	
a	Minimum interior head room (centre line of gangway) mm	1900 including that in the rear overhang area.

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
i	At front axle:	As per AIS 052
ii	At rear axle:	As per AIS 052
ii	Other areas	As per AIS 052
b	Gangway width (mm) from gates to longitudinal space between seats (access to service doors)	(Ref figure-1) minimum 700 mm excluding armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge. In case of front engine buses, clear passage available between front seat row and engine should not be less than 400 mm.
c	Gangway width (mm) in longitudinal space between seats	As above
d	Gangway width (mm) in longitudinal space between seats (rear of rear edge of the rear door in rear engine bus)	As above
e	Driver's working space	As per AIS 052
	Driver's seat	As per AIS 052
15.8	Corrosion prevention & painting	As per clause 3.17 of AIS 052
a	Corrosion prevention treatment	
	Internal surfaces of structural members	
	External surfaces of structural members	
	After drilling holes/welding	
	Intermetallic galvanic corrosion prevention	
b	Primer coating	
c	Painting:	
16	Electrical system	BIS marked, copper conductors with fire retardant as per IS/ISO:6722:2006 as per appropriate class. conductor x-sec varying as per circuit requirements, minimum cross-section 0.5 sq mm. quality marking may also be as per equivalent or better European, Japanese, US standards
16.1	Electrical cables:	
16.2	Conductor cross section	

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
16.3	Safety requirements of electrical	As per AIS 052
a	Fuse	
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	
c	Location of cables away from heat sources	
d	Type approval of circuit diagram as per Standards related to electric equipments/wiring	
e	Battery cut - off switch (isolator switch):	
16.4	Wind screen wiper:	Electrically operated with two wiper arms & blades, wiper motor heavy duty steel body with minimum 2-speed operation wiping system as per CMVR/BIS:7827 part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011
a	Wiper motor:	Variable speed with time delay relay as per AIS 011
b	Wiper arm/Blade:	As per AIS 019/AIS 011
16.5	Driver cabin fan	1 number, 200 mm fan as per provision of CMVR, matching interiors
16.6	Lighting - internal & external and illumination	As per AIS 052
16.7	Illumination requirements/performance of:	
a	Dash board tell tale lighting/control lighting	As per AIS 052
b	Cabin lighting - luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of $\geq$ 100 lux & $\leq$ 200 lux
c	Passenger area lighting -luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of $\geq$ 100 lux and $\leq$ 150 lux
17	ITS enabled bus	As specified separately under ITS specifications
18	Safety related items:	
18.1	Driver seat belt & anchorage duly type approved.	ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS 005 & 015
18.2	Passengers seat belt:	Not necessary except diver seat & wheel chair (performance etc. as per

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
	Number:	AIS 052)
18.3	Driver/Passenger/Wheel chair seat belt anchorage	
18.4	Fire extinguisher:	As per AIS 052
18.5	First aid box:	1 number, as per provision of CMVR
18.6	Handrails minimum length*diameter*height above floor in mm	Colour contrasting and slip resistant of aluminium tubing 32 mm dia, 3 mm thick. rest as per AIS 052
18.7	Handholds:	Colour contrasting and slip resistant. 2 to 4 numbers. Handholds per bay. rest as per AIS 052
18.8	Stanchions:	Vertically fitted, aluminium tubing with colour contrasting and slip resistant. 40 mm diameter & 3.15 mm thick. Rest as per AIS 052. As an alternative to stanchions mounted on bus floor, stanchions mounted on top of seat frames (new version seats) be explored (refer figure-2).
18.9	Bells for Passenger convenience	High visibility bell pushes shall be fitted at a height of 1.2 meter on all alternate stanchions. These would assist PwDs
18.10	Applicable for BRTS	
18.11	Window guardrails:	As per AIS 052. An additional guard rail in the rear part of bus in view of raised seating.
a	In all school buses - minimum numbers.	
b	In all other buses- minimum numbers.	
c	In AC super deluxe buses	
d	Other details:	
i	First guard rail at a height from window sill in mm	
ii	The distance between two guard rails in mm	
18.12	Entrance/Exit guard/Step well guard:	800 mm minimum height extending ≥ 100mm more than centre line of sitting position of the Passenger.
18.13	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR
18.14	Front/Rear door, stepwell lights, door open sign	Incandescent bulb/LED as per AIS 008

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
18.15	Mirrors right/left side exterior/interior:	Convex as per AIS 001 & 002.Interior with double curvature
18.16	Towing device front/rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus with 30^{o} of the longitudinal axis of the bus. As per CMVR & IS 9760 - ring type
18.17	Warning triangle	As per AIS 052/CMVR
18.18	Fog lighting	As per AIS 052/CMVR
18.19	Bumpers - front and rear	Both made of steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system
	Impact strength for bumpers	Meet requirements of paragraph 6.3.1 of AIS 052
19	Miscellaneous items/requirements	
19.1	Windows	
a	Type of window	Sliding type window panes except AC bus
b	Minimum height of window aperture (clear vision)[4] in mm	≥ 950
c	Minimum height of upper edge of window aperture from bus floor	As per AIS 052
d	Minimum width of windows (clear vision zone)	As per AIS 052
19.2	Cabin luggage carrier	As per AIS 052
19.3	Life cycle requirements of bus (whichever is earlier)	12 years or 10,00,000 km
20	Air conditioning system - test procedure for type approval	
20.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature
20.2	Target results	a) 24± 4°C (up to 42°C) b) Temperature gradient of 15° (> 42°C of saloon temperature) e.g. If the saloon temperature is 45˚, then the target temperature inside the bus is 45˚-15˚= 30˚

[4] Clear vision includes partition between fixed and sliding glass subject to a maximum width of 100 mm

	Bus specifications of standard size urban bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 400/650/900[1] mm
		c) Minimum average air velocity at air vent is 4.5 m/s
20.3	Apparatus	Lab condition and heating chamber
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum) (for more than 42°C of saloon temperature, pull down time within 40 minutes (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers. at nose level
20.5	Air Curtains on entry/exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding/alighting of Passenger with min air flow of 1000±50 m^3/hr at each gate. Type of air curtains at entry exit gates their power consumption etc be accounted for while deciding engine power, etc	Required
21	Additional requirements	
21.1	Air circulations and ventilation in driver's area	An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab
		Drivers work area to be provided with blower or suitable device (200 mm diameter fan) to ensure proper ventilation. These devices may be capable of 3 – speed adjustment
21.2	Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)-test procedure as per AIS 020	84 dba (to be achieved a maximum noise level of 81 dba from 1st April 2015 onwards)
22	Fuel efficiency requirement	While tendering purchaser may take into account the higher weightage for more fuel efficient vehicle under standard test conditions

Chapter - 03

Specifications for Mini and Midi bus

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
	Bus Floor heights in mm	Maximum floor height 900 mm with inclusion of variants of having floor height of 400 mm& 650mm	
	Definition of low floor area	"Low floor area shall not be less than 50% of the total saloon area (excluding front wheel boxes and driver's cab) and shall not be ramped in the longitudinal plane"	
1	Propulsion system	ICE. electrical, hybrid, fuel cell	
2	Fuel-options	Fuel to be compatible with propulsion system & prescribed emission norms	
3	Engine	Fuel compatible engine	
3.1	Engine HP sufficient to provide :		
a	Rated performance at GVW in a stop/start urban operations	Geared maximum speed without speed limiter to be minimum 75 kmph	
b	An acceleration (meter/sec^2)	≥ 0.8	
c	Attain bus speed of 0-30 kmph in seconds	≤ 10.5	
d	Maximum speed	Geared maximum speed without speed limiter to be minimum 75 kmph	
e	Grade ability from stop at GVW	17%	
f	Rated HP / torque preferably at lower rpm/rpm range	Maximum engine torque required at lower range of RPM and spread over a wider range of RPM	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
g	Power requirements for Air conditioning system, ITS etc.	Required	
3.2	Emission norms	BS III/BS IV/latest as applicable	
3.3	Engine management	Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, engine % load (torque), diagnostic message (engine specific)	
3.4	Engine operational requirements	Engine should be able to operate efficiently at ambient temperatures of approximately 0^{o} to 50^{o}C, humidity level from 5% to 100%, and altitude levels of up to 2000 meters, generally operating in the semi arid zone/hilly region prevailing in the area.	
3.5	Engine location	Optional	
3.6	Transmission		
a	Automatic with torque convertor. Neutral during stops	Purchaser to select any one transmission system. However, rear engine buses to have either automatic or automated manual transmission system only. (any bus delivered after 1st April, 2015 will mandatorily have either automatic or automated manual transmission system)	
b	Automated manual		
c	Manual - synchromesh - forward speeds (minimum 5) & constant mesh on reverse gear		
d	Mounting	Column or floor Optional	
4	Operational safety	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)	
5	Clutch (where applicable)	Dry, single plate, power assisted operation	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
5.1	Rear axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations	
5.2	Front axle	Heavy duty reverse Elliot type axle suitable for various floor heights	
6	Steering system	Hydraulic power steering	
7	Suspension system	Optional (air suspension/independent/parabolic/weveller)- irrespective of the type of suspension, floor level of bus should not go beyond maximum floor height (any bus delivered after 1st April, 2015 will mandatorily have air suspension or superior)	
7.1	Front		
7.2	Rear		
7.3	Kneeling (mm) applicable in case of air suspension (required only for 400 mm floor height buses)	60 mm entry/exit side severally & collectively	
7.4	Anti roll bars /stabilizers[1]	Both front and rear	
7.5	Shock absorbers	Hydraulic double acting 2 at front & 2/4 at rear	
7.6	Controls (optional)	Electronically controlled air suspension system	
8	Braking system	Dual circuit full air brakes, with preferably disc type arrangement for front and drum at rear brakes. Graduated hand controlled, spring actuated parking brakes acting on rear wheels (any bus delivered after 1st April, 2015 will mandatorily have disk brake in front)	
8.1	Anti skid anti brake locking system (ABS)	As per CMVR	
8.2	Electronic controls (optional)	√	
9	Electrical system	12/24[2] volt DC	24 volt DC

[1] Optional in case of independent suspension
[2] 24 Volt mandatory after April 2015

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
9.1	Batteries:	Low maintenance type lead acid batteries for 12/24 V (as applicable) system- performance as per BIS:14257-1995(latest). 2*12V of commensurate capacity. Maintenance free batteries preferred.	
9.2	Self Starter	12/24V[2]	24V
9.3	Alternator	12/24V[2]	24V
9.4	Electrical wiring & controls -type	As specified separately under ITS specifications	
10	Speed limiting device (optional):	Electronic type duly approved /certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit	
11	Tyres	Steel radial tube-less. Size and performance as per CMVR	
12	Fuel tank	Capacity of diesel fuel tank/ CNG cylinders adequate to enable bus operation of up to 250 km between consecutive fillings	
	Fuel tank location	Optional	
13	Bus characteristics		
13.1	Bus dimensions in mm		
a	Overall length (over body excluding bumper)	≤ 7000	≤ 9400
b	Overall width (sole bar/floor level- extreme points)	≤ 2200	≤2500
c	Overall height (unladen-at extreme point)	3300 (maximum)	3800 (maximum)
d	Wheel-base	≥3000	≤ 5000
i	Front overhang	As per CMVR	
ii	Rear overhang	As per CMVR	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
13.2	Turning circle radius (mm)-minimum	As per CMVR	
13.3	Floor height above ground (mm) - maximum	900/650/400	900/650/400
13.4	Clearances (mm)		
a	Axle clearance (mm)	Minimum 190 mm	
b	Wheel area clearance (mm)	> 220 mm for parts fixed to bus body & > 170 mm for the parts moving vertically with axle.	
c	Minimum ground clearance (un-kneeled) at GVW	Within the wheelbase not less than 240 mm.	
13.5	Angles (degrees)		
a	Angle of approach (unladen)	Not less than 8.0°	
b	Angle of departure (unladen)	Not less than 8.5°	
c	Ramp over angle (half of break-over angle)	Minimum 4.8°	
14	Bus Gates/Doors		
14.1	Entry exit gates with doors		
a	Operating mechanism	Electrically/Electro pneumatically controlled	Electro pneumatically controlled
b	Maximum opening closing time in seconds per operation	4	
c	Positions of door controls	As per AIS 052	
d	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory	
14.2	Front service doors - near side:	√	√

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
a	Door aperture (without flaps) in mm	As per AIS 052	
b	Clear door width (fully opened) in mm	As per AIS 052	
c	Door height in mm	As per AIS 052	
d	Positioning front service gate	As per AIS 052	
e	Number of gates minimum.	1	
14.3	Rear service doors (near side): where provided	Optional and at the discretion of purchaser	
a	Door aperture (without flaps) in mm	As per AIS 052	
b	Clear door width (fully opened) in mm	As per AIS 052	
c	Door height in mm	As per AIS 052	
d	Positioning rear door with respect to centre line of rear axle.	As per AIS 052	Preferably rear edge of gate 1500 mm ahead of centre line of rear axle or front edge of gate 1500 mm behind centre line of rear axle
e	Number of gates	1	
14.4	Applicable for BRTS		
14.5	Applicable for BRTS		
14.6	Maximum first step height (mm) from ground - unladen & un-kneeled position in buses with:		
a	Stepped type entry	400	400
b	No step entry/level entry (maximum)	900/650/400	900/650/400
14.7	Maximum height (mm) of other steps		
a	if door ahead of rear axle	250	250

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
b	if door behind rear axle	300	300
14.8	Ramp for wheel chair at the gates	Sunken type wrap over (manually operated) ramp, for wheel chair of PwDs, fitted on floor at gate in front of PwD seat anchorage. Suitable design mechanism for 650/900mm floor ht considering that floor level of bus stops are at 400mm	
a	Dimensions	As applicable for 14.8	
b	Material		
c	Load carrying capacity		
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200 mm		
e	Device to lock wrapped up ramp		
f	Kneel ramp control: (applicable in reference of clause 7.3)	Kneeling arrangement for kneeling on left side severally and combined. Kneeling up to 60mm	
g	Requirement for passenger with limited mobility	√	
i	Wheel chair anchoring - minimum for one wheel chair	√	
ii	Priority seats - minimum 2 seats	√	
iii	Stop request- on every pillar	√	
h	Emergency doors / exits or apertures (numbers)	As per AIS 052	
	Dimensions in mm	As per AIS 052	
i	Door closing requirements for bus movement	Bus could move only after door closing completed	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
i	Power operated service door - construction & control system of a power operated service door be such that a Passenger is unlikely to be injured/trapped between the doors while closing.	As per AIS 052	
ii	Door components	As per AIS 052	
iii	Door locks/locking systems/door retention	As per AIS 052	
iv	Door hinges	As per AIS 052	
15	Bus body		
15.1	Design type approval	As per Annexure-3	
15.2	Bus structure - materials specifications etc	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3	
15.3	Insulation		
a	Roof structure/body	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3	
b	Engine compartment		
15.4	Aluminium extruded sections for:		

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
a	Rub rail	Aluminium extrusion IS 733/1983 or better	
b	Decorative moulding		
c	Wire cover		
d	Wearing strip		
e	Foot step edging		
f	Panel beading		
g	Window frame		
h	Roof grab rail brackets		
15.5	Floor type / materials etc		
a	Type of floor	As per AIS 052	Flat except at wheel arches in the low floor area of bus- seats may be located over the wheel arches
b	Type of floor	Applicable only for BRTS	
c	Steps on floor	No steps except those necessary on near side gates or in rear side for rear engine buses	No steps except those necessary on near side gates or in rear side for rear engine buses
d	Steps on floor	N/A	
e	Maximum floor slope	As per AIS 052	
f	Floor surface material	12 mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
		gms/cc conforming to IS 3513(Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000(IS15061:2002),	
g	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy	
15.6	Safety glasses and fittings:		
a	Front windscreen (laminated) glass:	Single piece laminated safety glass, plain, flat/curved with curved corners with PVB film IS 2553 (Part-2)-1992/latest. Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
b	Rear windscreen: (wherever provided)	Single piece flat/curved toughened glass-plain/flat/curved at centre & curved at corners IS 2553 (Part-2)–1992/latest.	
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
c	Side windows:	Flat, 2-piece design-top fixed/sliding & bottom sliding toughened glass IS 2553 (Part-2)-1992/latest.	
d	Glass specifications	Toughened glass IS 2553 (Part-2)-1992/latest	
	Glass thickness:	Minimum 4.0 mm	4.8-5.3 mm
e	Window & other glasses - material specifications, thickness etc	Toughened as per IS 2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness	
f	Safety glass	As per AIS 052/ CMVR	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
g	Rear view mirrors	As per AIS 052	
15.7	Seating and gangway etc		
15.7.1	Passenger seating's for ordinary type-1 buses	As per AIS 052	
a	Seat layout in the low floor area	As per AIS 052	
b	Seat layout in the higher floor area		
c	Seat area/seat space per passenger (width*depth) mm	400*350	
d	Seat pitch - minimum in mm	As per AIS 052	
e	Minimum backrest height-from floor to top of seat/headrest	As per AIS 052	
	Seat base height-distance from floor to horizontal front upper surface of seat cushion mm.	As per AIS 052	
	Seat back rest height in mm	350	375
f	Torso angle (degrees)	Minimum 12^0	
g	Seat materials	'PPLD/LDPE' moulded AIS 023 & bus code for performance	
h	Seat frame structure material where required:	Frame structure of ERW steel tube	
i	Free height over seating position in mm	More than 800	
	Seat base height:	As per AIS 052	
j	Clearance space for seated Passenger facing partition mm	As per AIS 052	
k	Seat back / Pad material / Thickness: (optional)	Polyurethane foam IS15061:2002, 30± 5 mm (padding is optional)	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
	Type:	MDI moulded IS 5509	
	Upholstery:	Pile Fabric/Jekard 0.7-1mm thickness	
l	Area for seated passengers (sq. mm.):	400*350	
m	Area for standee passengers (sq. mm.):	As per AIS 052	
n	Number of seats including one for wheel chair	13-22	23 - 34
o	Number of standees (calculation As per AIS 052)	As per AIS 052	
p	Seats side facing location	Not suggested except on wheel arches	
q	Seat back rest	Fixed	
r	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)	
s	Performance & strength requirements of:	√	
i	Driver seat	As per AIS 023	
ii	Passenger seats	As per AIS 023	
15.7.2	Gangway:		
a	Minimum interior head room (centre line of gangway) in mm	1750 mm for standee type &1500 mm for non standee type	1900 mm including that in the rear overhang area.
i	At front axle:	As per AIS 052	
ii	At rear axle:		
iii	Other areas		

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
b	Gangway width (mm) from gates to longitudinal space between rows of seats (access to service doors)	(Refer figure-1) minimum 600 mm excluding armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge. In case of front engine buses, clear passage available between front seat row and engine should not be less than 400 mm.	
c	Gangway width (mm) in longitudinal space between rows of seats	As above	
d	Gangway width (mm) in longitudinal space between rows of seats (rear of rear edge of the rear door in RE bus)	As above	
e	Driver's working space	As per AIS 052	
	Driver's seat	As per AIS 023 & AIS 052	
15.8	Corrosion prevention & painting	As per clause 3.17 of AIS 052	
a	Corrosion prevention treatment	As per clause 3.17 of AIS 052	
	Internal surfaces of structural members		
	External surfaces of structural members		
	After drilling holes / welding		
	Inter metallic galvanic corrosion prevention		
b	Primer coating		
c	Painting:		
16	Electricals		

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
16.1	Electrical cables:	BIS marked, copper conductors with fire retardant as per IS/ISO: 6722:2006 as per appropriate class. Conductor cross-section varying as per circuit requirements, min cross-section 0.5 sq mm. Quality marking may also be as per equivalent or better European, Japanese, US standards	
16.2	Conductor cross section	As above and suitable to carry rated current (Japanese auto standard JASO D0609-75 AV)	
16.3	Safety requirements of electrical	As per AIS 052	
a	Fuse	As per AIS 052 - fuse of rated current 1.5 times the load current of electrical equipment. Necessary in every electrical circuit	
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	As per AIS 052 - Isolation switch required for each such circuit	
c	Location of cables away from heat sources	As per AIS 052 - Required for each such circuit	
d	Type approval of circuit diagram as per standards related to electric equipments/wiring	As per AIS 052 - Required for all items	
e	Cable insulation with respect to heat	As per AIS 052	
f	Battery cut - off switch (isolator switch):	Heavy-duty type capable of carrying & interrupting total circuit load. 1 each near battery/driver	
16.4	Wind screen wiper:	Electrically operated with two wiper arms & blades, wiper motor heavy duty steel body with minimum 2-Speed operation wiping system as per CMVR/ BIS 7827 part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011	
a	Wiper motor:	Variable speed with time delay relay as per AIS 011	
b	Wiper arm/blade:	As per AIS 019/AIS 011	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
16.5	Driver cabin fan	1 number, 200mm fan as per provision of CMVR, matching interiors	
16.6	Lighting - internal & external and illumination	As per AIS 052	
16.7	Illumination requirements/performance of:		
a	Dash board tell tale lighting/control lighting	As per AIS 052 & bulbs tested for photometry as per IS 1606:1996	
b	Cabin lighting - luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of $\geq$ 100 lux & $\leq$ 200 lux	
c	Passenger area lighting - luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of $\geq$ 100 lux and $\leq$ 150 lux	
17	ITS enabled bus	As specified separately under ITS specifications	
18	Safety related items:		
18.1	Driver seat belt & anchorage duly type approved.	ELR recoil type 3 point mounting as per CMVR & AIS 052.conforming to AIS 005&015.	
18.2	Passengers seat belt:	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)	
	Number:		
18.3	Driver/Passenger/Wheelchair seat belt anchorage		
18.4	Fire extinguisher:	As per AIS 052	
18.5	First aid box:	1 number, as per provision of CMVR	
18.6	Handrails minimum length*diameter*height above floor in mm	Colour contrasting and slip resistant of aluminium tubing. 32 mm dia, 3 mm thick.	
18.7	Handholds:	Colour contrasting and slip resistant. 2 to 4 numbers. Handholds per bay	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
18.8	Stanchions:	Vertically fitted, aluminium tubing with colour contrasting and slip resistant. 40 mm dia & 3.15 mm thick. Rest As per AIS 052. As an alternative to stanchions mounted on bus floor, stanchions mounted on top of seat frames (new version seats) be explored (refer figure-2).	
18.9	Bells for Passenger convenience	High visibility bell pushes shall be fitted at a height of 1.2 meter on all alternate stanchions. These would assist PwDs	
18.10	Left Blank		
18.11	Window guardrails:	As per AIS 052. An additional guard rail in the rear part of bus in view of raised seating.	
a	In all school buses - minimum numbers.		
b	In all other buses - minimum numbers.		
c	In AC super deluxe buses		
d	Other details:		
i	First guard rail at a height from window sill in mm		
ii	The distance between two guard rails in mm		
18.12	Entrance/Exit Guard/Step well guard:	800 mm minimum height extending ≥ 100mm more than centre line of sitting position of the Passenger.	
18.13	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR	
18.14	Front/rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008	
18.15	Mirrors right/left side exterior/interior:	Convex as per AIS 001 & 002. Interior with double curvature	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
18.16	Towing device front /rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus with 30^{o} of the longitudinal axis of the bus. As per CMVR & IS 9760 - ring type	
18.17	Warning triangle	As per AIS 052/CMVR	
18.18	Fog lighting	As per AIS 052/CMVR	
18.19	Bumpers - front and rear	Both made of steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system	
	Impact strength for bumpers	Meet requirements of Para 6.3.1 of AIS 052	
19	Miscellaneous items/requirements		
19.1	Windows		
a	Type of window	Sliding type window panes except AC bus	
b	Minimum height of window aperture (clear vision)[3]	≥ 500 mm	≥ 950 mm
c	Minimum height of upper edge of window aperture from bus floor	As per AIS 052	
d	Minimum width of windows (clear vision zone)	As per AIS 052	
19.2	Cabin luggage carrier	As per AIS 052	
19.3	Life cycle requirements of bus (whichever is earlier)	12 years or 10,00,000 km	
20	Air conditioning system - test procedure for type approval		
20.1	Specifications	a) For up to 42°C of saloon temperature and b) > 42°C of saloon temperature	

[3] Clear vision includes partition between fixed and sliding glass subject to a maximum width of 100 mm

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
20.2	Target results	a) 24+/- 4°C (Up to 42°C) b) Temperature gradient of 15^0 (> 42°C of saloon temperature) eg. If the saloon temperature is 45˚, then the target temperature inside the bus is 45˚-15˚= 30˚ c) Minimum average air velocity at air vent is 4.5 m/s	
20.3	Apparatus	Lab condition and heating chamber	
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum)(for more than 42°C of saloon temperature, pull down time within 40 minutes (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers. at nose level	
20.5	Air curtains on entry /exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding / alighting of Passenger with min air flow of 1000±50 m^3/hr at each gate. Type of air curtains at entry exit gates their power consumption etc be accounted for while deciding engine power, etc	Required	
21	Additional requirements		
21.1	Air circulations and ventilation in driver's area	An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab	

	Bus specifications for Mini and Midi urban buses (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Mini Buses	Midi buses
		Drivers work area to be provided with blower or suitable device (200 mm diameter fan) to ensure proper ventilation. These devices may be capable of 3 – speed adjustment;	
21.2	Maximum noise levels inside the saloon (irrespective of AC, Non-AC/fuel type/engine location)-test procedure as per AIS020	84 dba (to be achieved a maximum noise level of 81 dba from 1st April 2015 onwards)	
22	Fuel efficiency requirement	While tendering purchaser may take into account the higher weightage for more fuel efficient vehicle under standard test conditions	

Chapter - 04

Specifications for Standard size BRT bus

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
	Definition of Floor area	Floor height of 400, 650 or 900 mm shall be uniform inside the vehicle
1	Propulsion system	ICE, electrical, hybrid, fuel cell
2	Fuel-options	Fuel to be compatible with propulsion system & prescribed emission norms
3	Engine	
3.1	Engine HP sufficient to provide:	
a	Rated performance at GVW in a stop/start urban operations	Geared maximum speed without speed limiter to be 75 kmph
b	Acceleration (meter/sec^2)	≥ 0.8
c	Attain bus speed of 0-30 kmph in Seconds	≤ 10.5
d	Maximum speed	Geared maximum speed without speed limiter to be 75 kmph
e	Grade ability from stop at GVW	17%
f	Rated HP/torque preferably at lower rpm range	Maximum engine torque required at lower range of RPM and spread over a wider range of RPM
g	Power requirements for Air conditioning system, ITS, etc	Required
3.2	Emission norms	BS III/BS IV or latest as applicable
3.3	Engine management	Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, diagnostic details message (engine specific)
3.4	Engine operational requirements	Engine should be able to operate efficiently at ambient temperatures of approximately 0° to 50° C, humidity level from 5% to 100%, and altitude levels of up to 2000 meters, generally operating in the semi arid zone/hilly region prevailing in the area.
3.5	Engine location	Optional
3.6	Transmission	
a	Automatic with torque convertor. Neutral during stops	Purchaser to select any one transmission system.
b	Automated manual	

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
c	Manual - synchromesh - forward speeds (minimum 5) & constant mesh on reverse gear	Not applicable for BRTS
4	Operational safety	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)
5	Clutch (where applicable)	Dry, Single plate, power assisted operation
5.1	Rear axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations
5.2	Front axle	Heavy duty reverse Elliot type axle suitable for various floor heights
6	Steering system	Hydraulic power steering with height and angle adjustment
7	Suspension system[1]	Pneumatic
7.1	Front	Air bellows - 2 numbers
7.2	Rear	Air bellows – 2/4 numbers
7.3	Kneeling	Not Required
7.4	Anti roll bars/stabilizers[2]	Both front and rear
7.5	Shock absorbers	Hydraulic double acting 2 at front & 2/4 at rear
7.6	Controls (optional)	Electronically controlled air suspension system
8	Braking system	Dual circuit full air brakes, with preferably disc type arrangement for front and drum at rear brakes. Graduated hand controlled, spring actuated parking brakes acting on rear wheels (Any bus delivered after 1st April, 2015 will mandatorily have disc brake in front)

[1] Only in case of 900 mm floor height buses, front suspension can have option of air suspension/independent/parabolic/weveller type. Irrespective of the type of suspension, floor level of bus should not go beyond maximum floor height. Any bus delivered after 1st April, 2015 will mandatorily have air suspension or superior in both front & rear.

[2] Optional in case of independent suspension

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
8.1	Anti skid anti brake locking system (ABS)	As per CMVR
8.2	Electronic controls	Optional
9	Electrical system	24 volt DC
9.1	Batteries:	Low maintenance type lead acid batteries for 24 V system- performances as per BIS: 14257-1995 (latest). 2*12V of commensurate capacity. Maintenance free batteries preferred.
9.2	Self Starter	24V
9.3	Alternator	24V (another alternator of similar capacity for AC buses)
9.4	Electrical wiring & controls -type	As specified separately under ITS specifications
10	Speed limiting device (optional)	Electronic type duly approved/certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit
11	Tyres	Steel radial tube-less. Size and performance as per CMVR
12	Fuel Tank	Capable to enable bus operation ≥ 300 km between consecutive fillings
	Fuel Tank location	Optional
13	Bus characteristics	
13.1	Bus dimensions mm	
a	Overall length (over body excluding bumper)	12000 (minus tolerance of 100)
b	Overall width (sole bar/floor level- extreme points)	2600 (maximum)
c	Overall height (unladen - at extreme point)	3800 (maximum)
d	Wheel-base	6100 (tolerance of -200 + 400)
i	Front Overhang	As per CMVR
ii	Rear Overhang	As per CMVR
13.2	Maximum turning circle radius (mm)	As per CMVR
13.3	Floor height above ground (mm)	≤ 400/650/900 (tolerance -20)
13.4	Clearances (mm)	

	Bus specifications of standard BRTS bus (AC/Non-AC)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:400/650/900 mm	
a	Minimum Axle clearance (mm)	190 mm	
b	Wheel area clearance (mm)	> 220 mm for parts fixed to bus body & > 170 mm for the parts moving vertically with axle.	
c	Minimum ground clearance (un-kneeled) at GVW	Within the wheelbase not less than 240mm.	
13.5	Angles (degrees)		
a	Angle of approach (unladen)	Not less than 8.5°	
b	Angle of departure (unladen)	Not less than 9.0°	
c	Ramp over angle (half of break-over angle)	Not less than 4.8°	
14	Bus Gates/Doors		
14.1	Type of doors	Preferably in-swing in front with option of jack knife and double jack knife in rear door	
a	Operating mechanism	Electro pneumatically controlled	
b	Opening/Closing time in seconds per operation (maximum)	4	
c	Positions of door controls	On dashboard and also inside & outside of doors	
d	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory	
14.2	Front service doors (refer "A" in fig -1) - (near side/non-driver side)	√	√
a	Minimum door aperture (without flaps) in mm	800	
b	Minimum clear door width (fully opened) in mm	650 ± 50	
c	Minimum door height in mm	1900	
d	Positioning front service gate	Ahead of front axle	
e	Number of gates	1	
14.3	Rear service doors (Near side/non-driver side)		

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
14.3.1	Not Applicable for BRTS	
14.3.2	Rear service doors -refer "C" in figure 1 (near side/non-driver side); steps required for non BRTS operations, steps not required for level boarding	Optional for Purchaser
a	Minimum door aperture (without flaps) in mm	1200 (minimum)
b	Minimum clear door width (fully opened) in mm	1000 ± 50
c	Minimum Door height in mm	1850
d	Positioning rear door	Purchaser to select any one of the two options.
i	Ahead of centre line of rear axle	Preferably rear edge of gate 1500 mm ahead of centre line of rear axle
ii	Behind the centre line of rear axle	Preferably front edge of gate 1500 mm behind centre line of rear axle
e	Number of gates	1
14.4	Entry/Exit door between wheels (near side/non driver)	
14.4.1	Entry/Exit door; refer "B" in figure 3– between wheels (near side/non driver side) ; steps required for non BRTS operations; steps not required for level boarding	Option one door & steps optional - purchaser to decide option one or two or three
a	Door aperture (without flaps) in mm	1200
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Fixed Partition between gates - full height	Optional (Purchaser to decide)
e	Width of partition in mm	400 (maximum)
f	Location of partition	Vertical centre line of partition maximum 5800 mm and minimum 4300 mm from the front edge of bus; (Purchaser to specify preferred distance as per their BRT facility)
g	Positioning doors with respect to partition.	One on each side of the partition

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
h	Number of gates	2
14.4.2	Entry/Exit door; refer "B" in figure 3 – between wheels (near side / non driver side) ; steps required for non BRTS operations; steps not required for level boarding	Option Two door width & steps optional - Purchaser to decide option one or two or three
a	Door aperture (without flaps) in mm	1200
b	Clear door width (fully opened) in mm	1000 ± 50 (minimum)
c	Door height in mm	1900 (minimum)
d	Location of partition	N/A
e	Positioning doors with respect to partition.	N/A
f	Number of gates	1
g	Positioning gates	Vertical centre line of aperture maximum 5800 mm and minimum 4300 mm from the front edge of bus; (Purchaser to specify preferred distance as per their BRT facility)
14.4.3	Entry/Exit door; refer "B" in figure 3 – between wheels (near side/non driver side); steps required for non BRTS operations; steps not required for level boarding	Option Three door width & steps optional - Purchaser to decide option one or two or three
a	Door aperture in mm	1500 mm
b	Clear door width (fully opened) in mm	1300 ± 50 (maximum)
c	Door height in mm	1900 mm (minimum)
d	Location of partition	N/A
e	Positioning doors with respect to partition.	N/A
f	Number of gates	1
g	Positioning doors	Vertical centre line of aperture maximum 5800 mm and minimum 4300 mm from the front edge of bus;(Purchaser to specify preferred distance as per their BRT facility)

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
14.5	Entry/Exit doors, refer "D" in figure 3 - for off side/driver side location - steps not required for level boarding	Required
a	Door aperture in mm	1200
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Fixed partition between gates - full height	Optional (Purchaser to decide)
e	Width of partition in mm	400 (maximum)
f	Location of partition	Vertical centre line of partition maximum 5800 mm and minimum 4300 mm from the front edge of bus; (Purchaser to specify preferred distance as per their BRT facility)
g	Positioning doors with respect to partition.	One on each side of the partition
h	Number of gates	2
14.6	Maximum first step height (mm) from ground - unladen & un-kneeled position in buses with:	
a	Stepped type entry (maximum)	400
b	Level entry (at station platform height)	No steps required
14.7	Maximum height (mm) of other steps (where required)	
a	if door ahead of rear axle	250
b	if door behind rear axle	250
14.8	Ramp for wheel chair at the gates wherever required	Sunken type wrap over (manually operated) ramp, for wheel chair of PwDs, fitted on floor at gate in front of PwD seat anchorage. Suitable design mechanism for 650/900mm floor height considering that floor level of bus stops are at 400mm
a	Dimensions	Minimum width 900 mm
b	Material	Aluminium alloy with anti-slip coating

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
c	Load carrying capacity (in kilograms)	> 300
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200mm	√
e	Device to lock wrapped up ramp	√
f	Kneel ramp control: (applicable in reference of clause 7.3)	Kneeling arrangement for kneeling on left side severally and combined. Kneeling upto 60mm
g	Requirement for passengers with limited mobility	√
i	Wheel chair anchoring - minimum for one wheel chair	√
ii	Priority seats - minimum 2 seats	√
iii	Stop request	√
h	Emergency doors/exits or apertures (Numbers)	As per AIS 052
	Dimensions in mm	As per AIS 052
i	Door closing requirements for bus movement -	Bus could move only after door closing completed
i	Power operated service door - construction & control system of a power operated service door to be such that a Passenger is unlikely to be injured/trapped between the doors while closing.	As per AIS 052
ii	Door components	As per AIS 052
iii	Door locks/locking systems/door retention items	As per AIS 052
iv	Door hinges	As per AIS 052
15	Bus body	
15.1	Design type approval	As per Annexure-3
15.2	Bus structure - materials specifications etc	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
		code. Material should fulfil strength etc. requirements indicated under Annexure-3
15.3	Insulation	
a	Roof structure	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3
b	Engine compartment	
15.4	Aluminium extruded sections for:	
a	Rub rail	Aluminium extrusion IS 733/1983 or better
b	Decorative moulding	
c	Wire cover	
d	Wearing strip	
e	Foot step edging	
f	Panel beading	
g	Window frame	
h	Roof grab rail brackets	
15.5	Floor type/Materials etc	
a	Not applicable for BRTS	
b	Type of Floor	Uniform flat floor
c	Not applicable for BRTS	
d	Steps on floor	No steps/hump inside bus except where required for entry/exit
e	Maximum floor slope	6%
f	Floor surface material	12mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513 (Part-3): type VI 1989 or latest. The flooring

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
		should also be boiling water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000 (IS15061:2002)
g	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy
15.6	Safety glasses and fittings:	
a	Front windscreen (laminated) glass:	Single piece laminated safety glass, plain, flat/curved with curved corners with PVB film IS 2553 (Part-2)-1992/latest. Standard designs for each variant of buses to be followed (Refer Annexure 1)
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)
b	Rear windscreen: (wherever provided)	Single piece flat/curved toughened glass-plain/flat/curved at centre & curved at corners IS:2553 (Part-2)–1992/latest
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)
c	Side windows:	Flat, 2-piece design-top fixed/sliding & bottom sliding toughened glass IS 2553 (Part-2)-1992/latest.
d	Glass specifications	Toughened glass IS2553 (Part-2)-1992/latest
	Glass thickness:	4.8-5.3mm
e	Window & other glasses - material specs, thickness etc	Toughened as per IS:2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness
f	Safety glass	As per AIS 052/CMVR
g	Rear view mirrors	As per AIS 052
15.7	Seating and gangway etc	
15.7.1	Passenger seating’s for ordinary type-1 buses	As per AIS 052
a	Seat layout in the low floor area	2x2
b	Seat layout in the higher floor area	2x2
c	Seat area/seat space per Passenger (width*depth) mm	400*350

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
d	Seat pitch - minimum (mm)	As per AIS 052
e	Minimum backrest height-from floor to top of seat/headrest	As per AIS 052
	Seat base height-distance from floor to horizontal front upper surface of seat cushion mm.	As per AIS 052
	Seat back rest height mm	375
f	Torso angle (degrees)	Minimum 12°
g	Seat materials	'PPLD/LDPE' moulded AIS:023 & AIS 052 for performance
h	Seat frame structure material where required:	Frame structure of ERW steel tube
i	Free height over seating position (mm)	More than 900
	Seat base height:	As per AIS 052
j	Clearance space for seated Passenger facing partition (mm)	Minimum 350
k	Seat back/Pad material/Thickness:	Polyurethane Foam IS15061:2002 (padding is optional)
	Type:	MDI Moulded IS 5509
	Upholstery:	Pile Fabric/Jekard 0.7-1.0 mm thickness
l	Area for seated passengers (sq. mm.) type 1 NDX/SDX:	400*350
m	Area for standee passengers (sq. mm.):	As per AIS 052
n	Number of seats including one for wheel chair	32 - 34
o	Number of standees	Calculation as per AIS 052
p	Sitting/Standing Ratio	Not required
q	Headrest	Not required
r	Seats side facing location	Not suggested except on wheel arches
s	Seat arm	Not required
t	Magazine pouch	Not required
u	Individual seat row fans	Not required

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
v	Reading lights	Not required
w	Seat back rest	Fixed
x	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
y	Performance & strength requirements of:	√
i	Driver seat	As per AIS 023
ii	Passenger seats	As per AIS 023
15.7.2	Gangway:	
a	Minimum interior head room (centre line of gangway) (mm)	1900 including that in the rear overhang area.
i	At front axle:	As per AIS 052
ii	At rear axle:	As per AIS 052
iii	Other areas	As per AIS 052
b	Gangway width (mm) from gates to longitudinal space between seats (access to service doors)	(Ref figure-1) minimum 700 mm excluding armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge.
c	Gangway width (mm) in longitudinal space between seats	As above
d	Gangway width (mm) in longitudinal space between seats (rear of rear edge of the rear door in rear engine bus)	As above
e	Driver's working space	As per AIS 052
	Driver's seat	As per AIS 052
15.8	Corrosion prevention & painting	As per clause 3.17 of AIS 052
a	Corrosion prevention treatment	
	Internal surfaces of structural members	
	External surfaces of structural members	

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
	After drilling holes/welding	
	Inter metallic galvanic corrosion prevention	
b	Primer coating	
c	Painting:	
16	Electrical system	BIS marked, Copper conductors with fire retardant as per IS/ISO: 6722:2006 as per appropriate class. Conductor cross-section varying as per circuit requirements, minimum cross-section 0.5 sq mm. Quality marking may also be as per equivalent or better European, Japanese, US standards
16.1	Electrical cables:	
16.2	Conductor cross section	
16.3	Safety requirements of electrical	As per AIS 052
a	Fuse	
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	
c	Location of cables away from heat sources	
d	Type approval of circuit diagram as per standards related to electric equipments/wiring	
e	Battery cut - off switch (isolator switch):	
16.4	Wind screen wiper:	Electrically operated with two wiper arms & blades, wiper motor heavy duty steel body with minimum 2-Speed operation wiping system as per CMVR/BIS:7827 Part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011
a	Wiper motor:	Variable speed with time delay relay as per AIS 011.
b	Wiper arm/blade:	As per AIS 019/AIS 011
16.5	Driver cabin fan	1 number, 200 mm fan As per provision of CMVR, matching interiors
16.6	Lighting - internal & external and illumination	As per AIS 052
16.7	Illumination requirements/performance of:	

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
a	Dash board tell tale lighting/control lighting	As per AIS 052
b	Cabin lighting - luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of ≥100 lux & ≤ 200 lux
c	Passenger area lighting - luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of ≥100 lux and ≤ 150 lux
17	ITS enabled bus	As specified separately under ITS specifications
18	Safety related items:	
18.1	Driver seat belt & anchorage duly type approved.	ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS 005 & 015
18.2	Passengers seat belt:	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
	Number/location	
18.3	Driver/Passenger/wheelchair seat belt anchorage	
18.4	Fire extinguisher:	As per AIS 052
18.5	First aid box:	1 number, as per provision of CMVR
18.6	Handrails minimum length*diameter*height above floor in mm	Colour contrasting and slip resistant of aluminium tubing 32 mm dia, 3 mm thick. Rest as per AIS 052
18.7	Handholds:	Colour contrasting and slip resistant. 2 to 4 numbers. Handholds per bay. Rest as per AIS 052
18.8	Stanchions:	Vertically fitted, aluminium tubing with Colour contrasting and slip resistant. 40 mm dia & 3.15 mm thick. Rest as per AIS 052. As an alternative to stanchions mounted on bus floor, stanchions mounted on top of seat frames (new version seats) be explored (refer figure-2).
18.9	Not applicable for BRTS	
18.10	Passenger stop request signal	High visibility bell pushes/pully chord/touch tape shall be fitted at a height of 1.2 meter on all alternate stanchions mainly for persons with disabilities. (optional)

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
18.11	Window guardrails:	
a	In all school buses - minimum numbers.	Not Applicable
b	In all other buses- minimum numbers.	As per AIS 052
c	In AC super deluxe buses	As per AIS 052
d	Other details:	
i	First guard rail at a height from window sill in mm	
ii	The distance between two guard rails in mm	
18.12	Entrance/Exit guard/Step well guard:	800 mm minimum height extending ≥ 100mm more than centre line of sitting position of the Passenger.
18.13	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR
18.14	Front/Rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008
18.15	Mirrors right/left side exterior/interior:	Convex as per AIS: 001 & 002. Interior with double curvature
18.16	Towing device front/rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus with 30° of the longitudinal axis of the bus. As per CMVR & IS 9760 - ring type
18.17	Warning triangle	As per AIS 052/CMVR
18.18	Fog lighting	As per AIS 052/CMVR
18.19	Bumpers - front and rear	Both made of steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system
	Impact strength for bumpers	Meet requirements of Para 6.3.1 of AIS 052
19	Miscellaneous items/requirements	
19.1	Windows	
a	Type of window	Sliding type window panes except AC bus
b	Minimum height of window aperture (clear vision)[3] in mm	≥ 950

[3] Clear vision includes partition between fixed and sliding glass subject to a maximum width of 100 mm

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
c	Minimum height of upper edge of window aperture from bus floor	As per AIS 052
d	Minimum width of windows (clear vision zone)	As per AIS 052
19.2	Cabin luggage carrier	As per AIS 052
19.3	Life cycle requirements of bus (whichever is earlier)	12 years or 10,00,000 km
20	Air conditioning system - test procedure for type approval	
20.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature
20.2	Target results	a) 24± 4°C (up to 42°C) b) Temperature gradient of 15° (> 42°C of saloon temperature) eg. If the saloon temperature is 45^{o}, then the target temperature inside the bus is 45^{o}-15^{o}= 30^{o} c) Minimum average air velocity at air vent is 4.5 m/s
20.3	Apparatus	Lab condition and heating chamber
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum) (for more than 42°C of saloon temperature, pull down time within 40 minutes (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers at nose level
20.5	Air curtains on entry/exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding/alighting of Passenger with min air flow of 1000±50 m^3/hr at each gate. Type of air curtains at entry exit gates their power consumption etc be accounted for while deciding engine power, etc	Required

	Bus specifications of standard BRTS bus (AC/Non-AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:400/650/900 mm
21	Additional requirements	
21.1	Air circulations and ventilation in driver's area	An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab
		Drivers work area to be provided with blower or suitable device (200 mm diameter fan) to ensure proper ventilation. These devices may be capable of 3 – speed adjustment
21.2	Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)-test procedure as per AIS 020	84 dba (to be achieved a maximum noise level of 81 dba from 1st April 2015 onwards)
22	Fuel efficiency requirement	While tendering purchaser may take into account the higher weight age for more fuel efficient vehicle under standard test conditions

Chapter - 05

Specifications for Mini and Midi BRT bus

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)			
S. No.	Description	Specifications		
		Mini Buses	Midi buses	
	Maximum Bus Floor heights in mm	Floor height of 400, 650 or 900 mm shall be uniform inside the vehicle	Floor height of 400, 650 mm shall be uniform inside the vehicle	Floor height of 900 mm shall be uniform inside the vehicle
	Definition of Low Floor area	"Low floor area shall not be less than 50% of the total saloon area (excluding front wheel boxes and driver's cab) and shall not be ramped in the longitudinal plane"		
1	Propulsion System	ICE, Electrical, Hybrid, Fuel Cell		
2	Fuel-options	Fuel to be compatible with propulsion system & prescribed emission norms		
3	Engine	Fuel compatible engine		
3.1	Engine HP sufficient to provide:			
a	Rated performance at GVW in a stop/start urban operations	Geared maximum speed without speed limiter to be 75 kmph		
b	Acceleration (meter/sec^2)	≥ 0.8		
c	Attain Bus speed of 0-30 kmph in seconds	≤ 10.5		
d	Maximum speed	Geared maximum speed without speed limiter to be 75 kmph		
e	Grade ability from stop at GVW	17%		
f	Rated HP/torque preferably at lower rpm range	Maximum engine torque required at lower range of RPM and spread over a wider range of RPM		
g	Power requirements for Air conditioning system, ITS, etc	Required		
3.2	Emission norms	BS III/BS IV/latest as applicable		

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
3.3	Engine management	Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, engine % load (torque), diagnostic message (engine specific)	
3.4	Engine operational requirements	Engine should be able to operate efficiently at ambient temperatures of approximately 0^{o} to 50^{o}C, humidity level from 5% to 100%, and altitude levels of upto 2000 meters, generally operating in the semi arid zone/hilly region prevailing in the area.	
3.5	Engine location	Optional	
3.6	Transmission		
a	Automated Manual Transmission (AMT)	Purchaser to select any one transmission system. However, rear engine buses to have either automatic or automated manual transmission system only. (any bus delivered after 1st April, 2015 will mandatorily have either automatic or automated manual transmission system)	
b	Manual synchromesh - forward speeds (minimum 5) & constant mesh on reverse gear (MT)		
c	Automatic transmission with torque convertor. Neutral during stops		
d	Mounting	Column or floor Optional	
4	Operational safety	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)	
5	Clutch (where applicable)	Dry, single plate, power assisted operation	
5.1	Rear axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations	
5.2	Front axle	Heavy duty reverse Elliot type axle suitable for various floor heights	
6	Steering system	Hydraulic power steering	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
7	Suspension system	Optional (air suspension/Independent/parabolic/weveller)- irrespective of the type of suspension, floor level of bus should not go beyond maximum floor height (any bus delivered after 1st April, 2015 will mandatorily have air suspension or superior)	
7.1	Front		
7.2	Rear		
7.3	Kneeling (mm) applicable in case of air suspension	Not Required	
7.4	Anti roll bars/stabilizers[1]	Both front and rear	
7.5	Shock absorbers	Hydraulic double acting 2 at front & 2/4 at rear	
7.6	Controls (optional)	Electronically controlled air suspension system	
8	Braking system	Dual circuit full air brakes, with preferably disc type arrangement for front and drum at rear brakes. Graduated hand controlled, spring actuated parking brakes acting on rear wheels (any bus delivered after 1st April, 2015 will mandatorily have disc brake in front)	
8.1	Anti skid anti brake locking system (ABS)	As per CMVR	
8.2	Electronic controls (optional)	√	
9	Electrical system	12/24[2] volt DC	24 volt DC
9.1	Batteries:	Low maintenance type lead acid batteries for 12/24 V (as applicable) system- performances as per BIS: 14257-1995 (latest). 2*12V of commensurate capacity. Maintenance free batteries preferred.	
9.2	Self starter	12/24V[2]	24V

[1] Optional in case of independent suspension
[2] 24 Volt mandatory after April 2015

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)			
S. No.	Description	Specifications		
		Mini Buses	Midi buses	
9.3	Alternator	12/24V[2]	24V	
9.4	Electrical wiring & controls –type	As specified separately under ITS specifications		
10	Speed limiting device (optional):	Electronic type duly approved/certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit		
11	Tyres	Steel radial tube-less. Size and performance as per CMVR		
12	Fuel tank	Capacity of diesel fuel tank/CNG cylinders adequate to enable bus operation of up to 250 km between consecutive fillings		
	Fuel tank location	Optional		
13	Bus characteristics			
13.1	Bus dimensions in mm			
a	Overall length (over body excluding bumper)	≤ 7000	9000 (tolerance + 400 mm)	
b	Overall width (sole bar/floor level- extreme points)	≤ 2200	≤ 2500 (≤ 2200 Preferred; Purchaser to specify)	
c	Overall height (unladen-at extreme point)	3300 (maximum)	3800 (maximum)	
d	Wheel-base	≥ 3000	≤ 5000	
i	Front overhang	As per CMVR		
ii	Rear overhang	As per CMVR		
13.2	Turning circle radius (mm) - minimum	As per CMVR		
13.3	Floor height above ground (mm)	900/650/400 ± 20	650/400 ± 20	900 ± 20
13.4	Clearances (mm)			
a	Axle clearance (mm)	Minimum.190 mm		
b	Wheel area clearance (mm)	> 220 mm for parts fixed to bus body & > 170 mm for the		

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
		parts moving vertically with axle.	
c	Minimum ground clearance (un-kneeled) at GVW	Within the wheelbase not less than 240mm.	
13.5	Angles (degrees)		
a	Angle of approach (unladen)	Not less than 8.0°	
b	Angle of departure (unladen)	Not less than 8.5°	
c	Ramp over angle (half of break-over angle)	Minimum 4.8°	
14	Bus Gates/Doors		
14.1	Entry exit gates with doors		
a	Operating mechanism	Electrical/Electro pneumatically controlled	Electro pneumatically controlled
b	Maximum opening closing time in seconds per operation	4	
c	Positions of door controls	As per AIS 052	
d	Passenger safety system - allowing bus motion on doors closing	√	
14.2	Front service doors - near side:	√	
a	Door aperture (without flaps) in mm	As per AIS 052	
b	Clear door width (fully opened) in mm	As per AIS 052	
c	Door height in mm	As per AIS 052	
d	Positioning front service gate	As per AIS 052	
e	Number of gates minimum.	1	
14.3	Rear service doors (near side): where provided	Optional and at the discretion of purchaser	
a	Door aperture (without flaps) in mm	As per AIS 052	
b	Clear door width (fully opened)	As per AIS 052	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
c	Door height	As per AIS 052	
d	Positioning rear door with respect to centre line of rear axle	As per AIS 052	Preferably rear edge of gate 1500 mm ahead of centre line of rear axle or front edge of gate 1500mm behind centre line of rear axle
e	Number of gates	1	
14.4	Entry/Exit door – between wheels (near side/non driver side); station platform 400/650/900 mm level boarding	Required	
a	Door aperture in mm	1200 mm or 1500 mm (Purchaser to specify)	
b	Clear door width (fully opened)	1000 ± 50 minimum for 1200 mm or 1300 ± 50 maximum for 1500 mm	
c	Door height	1900 mm (minimum)	
d	Fixed partition between gates - full height	N/A	
	Width of partition in mm	N/A	
	Location of partition	N/A	
e	Positioning doors with respect to partition.	N/A	
f	Number of gates	1	
g	Positioning doors	Vertical centre line of the door aperture is centre line of wheel base	
14.5	Location of gates	Location on off side/driver side (to match the height of platform without steps)	
a	Door aperture (without flaps) in mm	1500	800
b	Clear door width (fully opened)	1300 ± 50	650
c	Door height	1900 mm (minimum)	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
d	Number of gates minimum	1	2
d	Fixed partition between gates - full height	N/A	Optional (Purchaser to decide)
	Width of partition in mm	N/A	400 (maximum)
	Location of partition	N/A	Vertical centre line of the partition is centre line of wheel base
e	Positioning doors with respect to partition.	One on each side of partition	
f	Number of gates	1	2
14.5	Intentionally left blank		
14.6	Maximum first step height (mm) from ground - unladen & un-kneeled position in buses with:		
a	Stepped type entry	400	
b	No step entry/level entry (at station platform height.)	900/650/400	900/650/400
14.7	Maximum height (mm) of other steps	In no case, bus floor height should go beyond the maximum floor height.	
a	if door ahead of rear axle	250	250
b	if door behind rear axle	250	250
14.8	Ramp for wheel chair at the gates, as applicable	Sunken type wrap over (manually operated) ramp, for wheel chair of PwDs, fitted on floor at gate in front of PwD seat anchorage. Suitable design mechanism for 650/900mm floor height considering that floor level of bus stops are at 400mm	
a	Dimensions	As applicable for 14.8	
b	Material		
c	Load carrying capacity		
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200mm		

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
e	Device to lock wrapped up ramp		
f	Kneel ramp control: (applicable in reference of clause 7.3)	Kneeling arrangement for kneeling on left side severally and combined. Kneeling up to 60mm	
g	Requirement for passenger with limited mobility	√	
i	Wheel chair anchoring - minimum for one wheel chair	√	
ii	Priority seats - minimum 2 seats	√	
iii	Stop request- on every pillar	√	
h	Emergency doors/exits or apertures (numbers)	As per AIS 052	
	Dimensions in mm	As per AIS 052	
i	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory	
i	Power operated service door - construction & control system of a power operated service door be such that a Passenger is unlikely to be injured/trapped between the doors while closing.	As per AIS 052	
ii	Door components	As per AIS 052	
iii	Door locks/locking systems/door retention items	As per AIS 052	
iv	Door hinges	As per AIS 052	
15	Bus body		
15.1	Design type approval	As per Annexure-3	
15.2	Bus structure - materials specifications etc	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc.	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
		requirements indicated under Annexure-3	
15.3	Insulation		
a	Roof structure/body	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3	
b	Engine compartment		
15.4	Aluminium extruded sections for:		
a	Rub rail	Aluminium extrusion IS 733/1983 or better	
b	Decorative moulding		
c	Wire cover		
d	Wearing strip		
e	Foot step edging		
f	Panel beading		
g	Window frame		
h	Roof grab rail brackets		
15.5	Floor type/materials etc		
a	Type of floor	N/A	
b	Type of floor	Uniform floor inside bus without steps	
c	Steps on floor	Not required	
d	Steps on floor	N/A	
e	Maximum floor slope	As per AIS 052	
f	Floor surface material	12mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513(Part-3): type VI 1989 or latest. The flooring should also be boiling	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
		water resistant as for marine board BIS:710-1976/ latest and fire retardant as per BIS:5509-2000(IS15061:2002)	
g	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy	
15.6	Safety glasses and fittings:		
a	Front windscreen (laminated) glass:	Single piece laminated safety glass, plain, flat/curved with curved corners with PVB film IS 2553 (Part-2)-1992/latest. Standard designs for each variant of buses to be followed (Refer Annexure 1)	
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
b	Rear windscreen: (wherever provided)	Single piece flat/curved toughened glass-plain/flat/curved at centre & curved at corners IS 2553(Part-2)–1992/latest	
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
c	Side windows:	Flat, 2-piece design-top fixed/sliding & bottom sliding toughened glass IS 2553 (Part-2)-1992/latest.	
d	Glass specifications	Toughened glass IS2553 (Part-2)-1992/latest	
	Glass thickness:	Minimum 4.0 mm	4.8-5.3mm
e	Window & other glasses - material specifications, thickness etc	Toughened as per IS 2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness	
f	Safety glass	As per AIS 052/CMVR	
g	Rear view mirrors	As per AIS 052	
15.7	Seating and gangway etc		
15.7.1	Passenger seating for ordinary type-1 buses	As per AIS 052	
a	Seat layout in the low floor area	As per AIS 052	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
b	Seat layout in the higher floor area		
c	Seat area/seat space per Passenger (width*depth) mm	400*350	
d	Seat pitch - minimum in mm	As per AIS 052	
e	Minimum backrest height-from floor to top of seat/headrest	As per AIS 052	
	Seat base height-distance from floor to horizontal front upper surface of seat cushion mm.	As per AIS 052	
	Seat back rest height in mm	350	375
f	Torso angle (degrees)	Minimum 12^0	
g	Seat materials	'PPLD/LDPE' moulded AIS:023 & bus code for performance	
h	Seat frame structure material where required:	Frame Structure of ERW steel tube	
i	Free height over seating position in mm	More than 800	
	Seat base height:	As per AIS 052	
j	Clearance space for seated Passenger facing partition mm	AIS 052	
k	Seat back/Pad material/Thickness: (optional)	Polyurethane foam IS15061:2002, 30±5 mm (padding is optional)	
	Type:	MDI moulded IS 5509	
	Upholstery:	Pile Fabric/Jekard 0.7-1mm thickness	
l	Area for seated passengers (sq.mm.):	400*350	
m	Area for standee passengers (sq.mm.):	As per AIS 052	
n	Number of seats including one for wheel chair	13-22	23-34
o	Number of standees (calculation as per AIS 052)	As per AIS 052	
p	Seats side facing location	Not suggested except on wheel arches	
q	Seat back rest	Fixed	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
r	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)	
s	Performance & strength requirements of:	√	
i	Driver seat	As per AIS 023	
ii	Passenger seats	As per AIS 023	
15.7.2	Gangway:		
a	Minimum interior head room (centre line of gangway) in mm	1750 mm for standee type &1500 mm for non standee type	1900 mm including that in the rear overhang area.
i	At front axle:	As per AIS 052	
ii	At rear axle:		
iii	Other areas		
b	Gangway Width (mm) from gates to longitudinal space between rows of seats (Access to service doors)	(Refer figure-1) minimum 600 mm excluding armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge.	
c	Gangway Width (mm) in longitudinal space between rows of seats	As above	
d	Gangway Width (mm) in longitudinal space between rows of seats (rear of rear edge of the rear door in RE bus)	As above	
e	Driver's working space	As per AIS 052	
	Driver's seat	As per AIS 023 & AIS 052	
15.8	Corrosion prevention & painting	As per clause 3.17 of AIS 052	
a	Corrosion prevention treatment	As per clause 3.17 of AIS 052	
	Internal surfaces of structural members		

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
	External surfaces of structural members		
	After drilling holes/welding		
	Inter metallic galvanic corrosion prevention		
b	Primer coating		
c	Painting:		
16	Electricals		
16.1	Electrical cables:	BIS marked, copper conductors with fire retardant as per IS/ISO: 6722:2006 as per appropriate class. Conductor cross-section varying as per circuit requirements, minimum cross-section 0.5 sq mm. Quality marking may also be as per equivalent or better European, Japanese, US standards	
16.2	Conductor cross section	As above and suitable to carry rated current (Japanese auto Standard JASO D0609-75 AV)	
16.3	Safety requirements of electrical	As per AIS 052	
a	Fuse	As per AIS 052 - fuse of rated current 1.5 times the load current of electrical equipment. Necessary in every electrical circuit	
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	As per AIS 052- Isolation switch required for each such circuit	
c	Location of cables away from heat sources	As per AIS 052- Required for each such circuit	
d	Type approval of circuit diagram as per standards related to electric equipments/wiring	As per AIS 052 - Required for all items	
e	Cable insulation with respect to heat	As per AIS 052	
f	Battery cut - off switch (isolator switch):	Heavy-duty type capable of carrying & interrupting total circuit load. 1 each near battery/driver	
16.4	Wind screen wiper:	Electrically operated with two wiper arms & blades, wiper	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
		motor heavy duty steel body with minimum 2-Speed operation wiping system as per CMVR/BIS 7827 part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011	
a	Wiper motor:	Variable speed with time delay relay as per AIS11.	
b	Wiper arm/blade:	AIS 019/AIS011	
16.5	Driver cabin fan	1 number, 200mm fan as per provision of CMVR, matching interiors	
16.6	Lighting - internal & external and illumination	As per AIS 052.	
16.7	Illumination requirements/performance of:		
a	Dash Board Tell tale lighting/control lighting	As per AIS 052 & bulbs tested for photometry as per IS 1606:1996	
b	Cabin Lighting - luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of ≥ 100 lux & ≤ 200 lux	
c	Passenger area lighting - luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of ≥ 100 lux and ≤ 150 lux	
17	ITS enabled bus	As specified separately under ITS specifications	
18	Safety related items:		
18.1	Driver seat belt & anchorage duly type approved.	ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS: 005&015.	
18.2	Passengers seat belt:	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)	
	Number:		
18.3	Driver/Passenger/wheelchair Seat Belt Anchorage		
18.4	Fire extinguisher:	As per AIS 052	
18.5	First aid box:	1 number, as per provision of CMVR	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
18.6	Handrails Minimum length*diameter* height above floor in mm	Colour contrasting and slip resistant of aluminium tubing 32 mm dia, 3 mm thick.	
18.7	Handholds:	Colour contrasting and slip resistant. 2 to 4 Numbers. hand holds per bay	
18.8	Stanchions:	Vertically fitted, aluminium tubing with Colour contrasting and slip resistant. 40 mm dia & 3.15 mm thick. Rest As per AIS 052. As an alternative to stanchions mounted on bus floor, stanchions mounted on top of seat frames (new version seats) be explored (ref figure-2).	
18.9	Bells for Passenger convenience	High visibility bell pushes shall be fitted at a height of 1.2 meter on all alternate stanchions. These would assist PwDs	
18.10	Left blank		
18.11	Window Guardrails:	As per AIS 052.	
a	In all school buses - minimum numbers.		
b	In all other buses - minimum numbers.		
c	In AC super deluxe buses		
d	Other details:		
i	First guard rail at a height from window sill in mm		
ii	The distance between two guard rails in mm		
18.12	Entrance/Exit Guard/Step well guard:	800 mm minimum height extending ≥ 100 mm more than centre line of sitting position of the Passenger.	
18.13	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR	
18.14	Front/rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008	
18.15	Mirrors right/left side exterior/interior:	Convex as per AIS 001 & 002. Interior with double curvature	
18.16	Towing device front/rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus with 30^{o} of the longitudinal axis of the bus. As per CMVR &	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
		IS 9760 - ring type	
18.17	Warning triangle	As per AIS 052/CMVR	
18.18	Fog Lighting	As per AIS 052/CMVR	
18.19	Bumpers - front and rear	Both made of Steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system	
	Impact strength for bumpers	Meet requirements of Para 6.3.1 of AIS 052	
19	Miscellaneous items/requirements		
19.1	Windows		
a	Type of window	Sliding type window panes except AC bus	
b	Minimum height of window aperture (clear vision)[3]	≥ 500 mm	≥ 950 mm
c	Minimum height of upper edge of window aperture from bus floor	As per AIS 052	
d	Minimum width of windows (clear vision zone)	As per AIS 052	
19.2	Cabin luggage carrier	As per AIS 052	
19.3	Life cycle requirements of bus (whichever is earlier)	12 years or 10,00,000 km	
20	Air conditioning system - test procedure for type approval		
20.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature	
20.2	Target results	a) 24+/- 4°C (Up to 42°C) b) Temperature Gradient of 15^0 (> 42°C of saloon temperature) e.g. If the saloon temperature is 45^o, then the	

[3] Clear vision includes partition between fixed and sliding glass subject to a maximum width of 100 mm

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
		target temperature inside the bus is 45^{o}-15^{o}= 30^{o} c) Min avg. air velocity at air vent is 4.5 m/s	
20.3	Apparatus	Lab condition and heating chamber	
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum) (for more than 42°C of saloon temperature, pull down time within 40 min (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers. at nose level	
20.5	Air curtains on entry/exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding/alighting of Passenger with min air flow of 1000±50 m^3/hr at each gate. Type of air curtains at entry exit gates their power consumption etc be accounted for while deciding engine power, etc	Required	
21	Additional requirements		
21.1	Air circulations and ventilation in driver's area	An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab	
		Drivers work area to be provided with blower or suitable device (200 mm diameter fan) to ensure proper ventilation. These devices may be capable of 3 – speed adjustment	
21.2	Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)-test procedure as per AIS 020	84 dba (to be achieved a maximum noise level of 81dba from 1st April 2015 onwards)	

	Bus specifications for Mini and Midi BRT buses (AC/Non-AC)		
S. No.	Description	Specifications	
		Mini Buses	Midi buses
22	Fuel efficiency requirement	While tendering purchaser may take into account the higher weight age for more fuel efficient vehicle under standard test conditions	

Chapter - 06

Specifications for Standard size bus of Premium segment

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
	Bus floor heights	As per AIS 052 (this segment of buses are envisaged to be more comfortable for seating passengers with lesser standees). However all buses to be delivered after 1st April 2015 will follow the same definition as in the case of non-premium buses) i.e. "low floor area shall not be less than 50% of the total saloon area (excluding front wheel boxes and driver's cab) and shall not be ramped in the longitudinal plane"
1	Propulsion system	Internal combustion engine, electrical, hybrid, fuel cell
2	Fuels-options	Diesel/CNG/ULSD/hydrogen
3	Engine	
3.1	Fuel recommended	Fuel to be compatible with propulsion system.
3.2	Engine HP sufficient to provide:	
a	Rated performance at GVW in a stop/start urban operations	Maximum vehicle speed of up to 75 kmph bus GVW
b	Acceleration (meter/sec^2) complemented with minimum 1000 Nm torque	0.8
c	Attain bus speed of 0-30 kmph	9.0 seconds
d	Maximum speed	$\leq$ 75 kmph
e	Grade ability from stop at 1.5 GVW	17%
f	Rated HP/torque preferably at lower rpm range	HP rating designed to provide rated torque of minimum 1000 Nm (under full load) preferably at lower range.
3.3	Maximum Fuel efficiency kmpl or kmpkg. Vehicle Manufacturer to specify fuel efficiency in terms of kmpl or kmpkg under standard 13 mode urban operating cycle and rated loading. While tendering, purchaser may take into account the higher weight age for more fuel efficient vehicle	√
3.4	Emission norms	BS III/BS IV or latest as applicable

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
3.5	Electronic engine management (EMS) system with following provisions amongst others:	Full electronic management of engine including on-board diagnostic and driver alerts e.g. engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, diagnostic details message (engine specific)
a	Fault tracing and diagnostics	√
b	Information generation about driver and vehicle performance as specified as part of ITS specifications	√
3.5.1	Typical EMS parameters	√
a	Fuel feed & fuel delivery system status related to:	√
i	Feed pump pressure	√
ii	Fuel delivery pressure	√
iii	Booster pressure and temperature	√
b	Coolant Status related to:	√
i	Coolant level	√
ii	Coolant temperature	√
iii	Coolant pressure	√
c	Engine oil status related to:	√
i	Oil level	√
ii	Oil temperature	√
iii	Oil pressure	√
d	Accelerator pedal position	√
e	Water in fuel indicator	√
f	Injector status	√
g	Engine position timing sensor	√
h	Engine speed sensor	√

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
i	Control and information links	√
i	SAE J1939 control link	√
ii	SAE J158 / J1708 Information link	√
3.6	Engine operational requirements	Engine should be able to operate efficiently at ambient temperatures of approximately 0^{o} to 50^{o}C, humidity level from 5% to 100%, and altitude levels of up to 2000 meters, generally operating in the semi arid zone/hilly region prevailing in the area.
3.7	Engine location	Rear
3.8	Transmission-heavy duty-	
	Automatic with torque convertor and in-built retarder - hydrodynamic type. Neutral during stops. Reduced engine load at stops (NBS)	√
4	Operational safety - transmission related	
4.1	Reverse gear engagement	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)
4.2	An interlock to prevent the movement of bus when doors opened	√
4.3	Drive shaft lubrication for life	√
5	Clutch (front and rear axle)	Not applicable
6	Steering system	Hydraulic power steering with height and angle adjustments provision. Adjustable steering column.
7	Suspension system	Fully pneumatic complete with ECAS/electronic management and control systems
7.1	Front	Air bellows - 2 numbers

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
7.2	Rear	Air bellows – 2/4 numbers
7.3	Kneeling (mm)	60mm entry/exit side severally & collectively
7.4	An interlock to prevent movement of bus when kneeled/kneeling	√
7.5	Anti roll bars/stabilizers[1]	Both front and rear
7.6	Shock absorbers	Hydraulic double acting 2 at front & 2/4 at rear
7.7	Controls	Electronically controlled air suspension or superior system
a	Electronic control suspension system for	√
b	Controlling floor level	√
c	Enhancing comfort by absorbing shocks in case of road irregularities	√
d	Uniform spring rate in all loading conditions	√
e	Self correction of bellow height to	√
i	Help protect driveline angularity related problems	√
ii	Counter road unevenness	√
iii	Monitor bellow failures	√
iv	Provide passenger comfort	√
8	Braking System	Dual circuit full air brakes, with disc type arrangement for front and rear brakes. Full pneumatic electronically controlled disc brakes with brake blending and rollback prevention system. Graduated hand controlled, spring actuated parking brakes acting on rear wheels.

[1] Optional in case of independent suspension

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
8.1	Anti skid anti brake locking system (ABS) necessary for urban driving cycle: i) involving high levels of unexpected braking requirements, ii) calling for excessive panic braking particularly in rainy season. iii) Requiring enhanced manoeuvrability, smooth stopping and low wear and tear of involved components.	√
8.2	Electronic braking control system (EBS) for uniform distribution of braking force on all wheels, contributing to smooth braking, optimizing braking with minimal pedal force thereby reducing driver fatigue.	√
8.3	Electronic monitoring of brakes	
a	Brake pad condition	√
b	Brake pad temperature condition	√
9	Electrical system	24 volt DC
9.1	Batteries	Low maintenance type lead acid batteries for 24 V system- performances as per BIS: 14257-1995 (latest). 2*12V batteries of 180 Ah capacity. Maintenance free batteries preferred.
9.2	Self starter	24V
9.3	Alternator	24V- another alternator of similar capacity for AC.
9.4	Electrical wiring & controls- type	As specified separately under ITS specifications
10	Speed limiting device (optional):	Electronic type duly approved/certified as per AIS: 018/2001 or latest, tamper proof and be adjusted to applicable speed limit
11	Tyres	Steel radial tube-less. Size and performance as per CMVR

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
12	Fuel tank	On-board fuel storage capacity adequate for bus operation of over 300 km between consecutive fillings
	Fuel tank location	Optional
13	Bus characteristics	
13.1	Bus dimensions mm	
a	Overall length (over body excluding bumper)	12000 (minus tolerance of 100)
b	Overall width (sole bar/floor level- extreme points)	2600 (maximum)
c	Overall height (unladen-at extreme point)	3800(Maximum)
d	Wheel-base	6100 (tolerance: -200 + 400)
e	Front overhang	As per CMVR
f	Rear overhang	As per CMVR
13.2	Turning circle radius (mm)	As per CMVR
13.3	Floor height above ground (mm)	≤ 900
13.4	Clearances (mm)	
a	Axle clearance (mm)	Minimum190
b	Minimum ground clearance (un-kneeled) at GVW	Within the wheelbase not less than 240mm.
13.5	Angles (degrees)	
a	Angle of approach (unladen)	Required $\geq 8.5^{o}$ (can be proportionately reduced with respect to floor height but should not be less than 8.0^{0})
b	Angle of departure (unladen)	Required $\geq 9.0^{0}$ (can be proportionately reduced with respect to floor height but should not be less than 8.5^{0})
c	Ramp over angle (half of break-over angle)	$\geq 4.8^{0}$
14	Bus gates/Doors	

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
14.1	Location of gates	Location on near side
14.2	Type of doors	Swing in/out type
a	Operating mechanism	Electro pneumatically controlled
b	Opening closing time in seconds per operation	≤ 4
c	Positions of door controls ensuring display of open/close status on dash board	On dashboard, as also inside & outside of doors for emergency operation and at stanchions for Passenger access
d	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory
14.3	Front service doors - near side:	√
a	Door aperture (without flaps) in mm	1200 (minimum)
b	Clear door width (fully opened) in mm	1050 ± 50 (minimum)
c	Door height in mm	1900 (minimum)
d	Positioning front service gate	Ahead of front axle
e	Number of gates	1
14.4	Rear service doors (near side):	√
a	Door aperture (without Flaps) in mm	1200 (minimum)
b	Clear door width (fully opened) in mm	1050 ± 50 (minimum)
c	Door height in mm	1900 (minimum)
d	Positioning rear door	Preferably rear edge of gate 1500 mm ahead of central line of rear axle or front edge of gate 1500 mm behind central line of rear axle
e	Number of gates	1
14.5	Maximum first step height (mm) from ground - unladen & un-kneeled position in buses with:	
a	Stepped type entry	400

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
14.6	Maximum height (mm) of other steps		
a	if door ahead of rear axle	250	
b	if door behind rear axle	NA	
14.7	Ramp for wheel chair at the gates	Sunken type wrap over (manually operated) ramp, for wheel chair of PwDs, fitted on floor at gate (preferably at front gate) in front of PwD seat anchorage.	Suitable design mechanism for > 400mm floor ht considering that floor level of bus stops are at 400mm
a	Dimensions	Width ≥ 900 mm	
b	Material	Aluminium alloy with anti-slip coating	
c	Load carrying capacity	> 300 kg	
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200mm	√	
e	Device to lock wrapped up ramp	√	
f	Kneel ramp control	Kneeling arrangement for kneeling on left side severally and combined. Kneeling up to 60mm	
g	Requirement for passenger with limited mobility	√	
h	Wheel chair anchoring- minimum for one wheel chair	√	
i	Priority seats- minimum 2 seats	√	
j	Stop request- on every pillar	√	
k	Place to keep PwD assists like cane, etc	√	
l	Colour contrasting/other guidance for persons with visual deficiencies	√	
m	Any other provisions to meet requirement of disabilities Act 1995	√	

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
14.8	Emergency doors/exits or apertures (numbers)	As per AIS 052
a	Dimensions mm	As per AIS 052
14.9	Door closing requirements for bus movement -	Bus could move only after door closing completed
a	Power operated service door - construction & control system of a power operated service door be such that a Passenger is unlikely to be injured/trapped between the doors while closing.	As per AIS 052
b	Door components	As per AIS 052
c	Door locks/locking systems/door retention items	As per AIS 052
d	Door hinges	As per AIS 052
15	Bus body	
15.1	Design type approval	
a	Design type approval- all bus body structures & structural aggregates be designed to fulfil the loading, operating & performance parameters using finite element analysis or any other analytic technique for:	Required
	Strength Stiffness Structural Stability Vibration Safety	
15.2	Structural performance	
a	Bus structure to meet requirements of:	

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
i	Body structure strength test- each type of vehicle be subjected to roll over test on complete vehicle/specified representative section thereof or to an alternate method approved by the test agency	As per AIS 052
ii	Stability	As per AIS 052
iii	Deflection	√
iv	Vibrations	√
v	Roll over protection	√
vi	Joint strength- body panel joints meet requirements of holding the joined panel when subjected to force of 60% of tensile strength of weakest joined body panel.	As per AIS 052
b	Various loads:	
i	Normal loads (static) = Number of Passenger*weight of Passenger (68 Kgs.) + Passenger luggage weight (7 Kgs). (Besides the vehicle related loads).	√
ii	Bump loads: # Bump height = As per relevant BIS/Indian Road Congress guidelines. # Case I: single wheel on bump/pot hole. # Case II: diagonally opposite wheels on Bump/Pot hole. # Case III: both wheels (front & rear) on bump/pot hole.	√
iii	Braking loads: 0.6g (applied together). Horizontal = 0.6g load, Vertical = 1g load	√

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
c	Bus body structure evaluation by a & or b	As under
i	Physical testing or	As per AIS 052
ii	Finite element method	As per AIS 052
d	Required performance values/data (minimum) for above load conditions:	As under
i	Strength (factor of safety) (tolerance -10%)	≥ 3 i.e. design stress ≥ 1/3rdof yield stress
ii	Stiffness (deflection) mm	5mm
iii	Vibrations (lowest natural frequency) hertz	5Hz
iv	Roll over tests with the bus rolling from ground level instead of a raised platform. Angular velocity should not exceed 5 degrees/second. All other procedure as per AIS031	(i) Unstable position should not occur before 35°. (ii) No part of structure intrudes into residual space.
	1. Bus tilted to its unstable position	
	2. Bus allowed falling freely under gravity from this position.	
	3. GVW of the bus to be considered	
v	4. Energy absorbed by the structure {E_R =Reference energy-- potential energy of the bus in its (unstable) equilibrium position). ER = M*g*h Where M= Effective weight of the bus, g = Acceleration due to gravity, h= Height of C.G. above ground level in (unstable) equilibrium position.}.	0.75 ER
vi	Buckling factor	≥ 4
15.3	Bus structure- materials specs etc	
a	Super structure	Material to be decided by the manufacturer OR as per the tender specifications

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
b	Under structure:	issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated above
c	Panelling	
i	Roof panelling: interior	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code Material should fulfil strength etc. requirements indicated above.
ii	Roof panelling: exterior	
iii	Side panelling: interior	
iv	Other side panels:	
v	Stretch panel: Exterior side panels of stretched steel sheet at different waist levels along length of the bus	
vi	Skirt Panel	
vii	Front end interior	
viii	Front end exterior	
ix	Rear end interior	
x	Rear end exterior	
15.4	Insulation	Material to be decided by the manufacturer subject to meeting requirement of flame retardancy, fire proofing and non-in flammability as per applicable standards
a	Roof structure	Flame retardant/non flammable-- polyurethane/glass wool IS 15061or latest of density 40 Kg/m3 minimum.
b	Engine compartment	Fire retardant preferably ceramic fibre 128 kg/m3
15.5	Aluminium extruded sections for:	
a	Rub rail	Aluminium extrusion IS 733/1983 or better
b	Decorative moulding	

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
c	Wire cover		
d	Wearing strip		
e	Foot step edging		
f	Panel beading		
g	Window frame		
h	Roof grab rail brackets		
15.6	Floor type/Materials etc		
a	Type of floor	Flat except at wheel arches in the low floor area of bus- seats may be located over the wheel arches	
b	Steps on floor	For 400 mm floor height: No steps except those necessary for the rear high floor area	For higher floor height: steps in the low floor area either at gates or across the floor. Steps may be provided as necessary on high floor in the rear side
c	Maximum floor slope	6 %	
d	Floor surface material	12 mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513 (Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS 710-1976/ latest and fire retardant as per BIS 5509-2000 (IS 15061:2002)	

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
e	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy
15.7	Safety glasses and fittings	Single piece windshield, stylish exterior, combination head lamps etc
a	Front windscreen (laminated) glass:	Single piece laminated safety glass, with PVB film IS 2553 (Part-2)-1992/latest. Front wind screen glass shape may be curved or plain, flat/curved with curved corners, to match vehicle design and contours etc.
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)
b	Rear windscreen: (wherever provided)	Single piece flat/curved or plain/flat at centre & curved at corners to match vehicle contours/design. Rear wind screen glass be toughened glass IS: 2553(Part-2)–1992/latest.
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)
c	Side windows:	Large flat/curved to match bus shape and contour, 1-piece design-fixed toughened glass IS2553 (Part-2)-1992/latest.
	Glass thickness:	4.8-5.3mm
	Minimum window glass/aperture area (main windows) in cm^2	14000
	Light transmission (%) in case of tinted glasses	As per CMVR
d	Window & other glasses - material specifications, thickness etc	Tinted and toughened as per IS 2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness
e	Safety glass	As per AIS 052/CMVR
f	Rear view mirrors	As per AIS 052

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
15.8	Seating and gangway etc for ACX buses generally as per AIS 052	Ergonomically designed seats with soft cushion head seats rest, spacious gangway etc.
15.8.1	Passenger seating's for ACX type-1 buses	As per AIS 052
a	Seat layout in the low floor area	2x2
b	Seat layout in the higher floor area	2x2
c	Seat area/seat space per Passenger (width*depth) mm as per AIS 052	450*450
d	Seat pitch - minimum: mm as per AIS 052	750
e	Minimum backrest height- from floor to top of seat/headrest	1100 mm from floor as per AIS 052
	Seat base height- distance from floor to horizontal front upper surface of seat cushion mm	As per AIS 052
f	Torso angle	Minimum 15^0 with option of reclining adjustable seats
g	Passenger seats with high back rest, contoured to suit human body, padded and provided with head rest	√
h	Seat materials	Cushioned seats with polyurethane foam as per IS15961-2002.
i	Seat frame structure material where required	Frame structure of ERW steel or aluminium tubes/sheets/formed sections
j	Free height over seating position mm	More than 900
	Seat base height	As per AIS 052

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
k	Clearance space for seated Passenger facing partition mm	As per AIS 052
l	Seat back/Pad material/thickness:	Polyurethane foam IS15061:2002, 50± 5 mm
	Type	Suitably moulded/fabricated and padded with > 50 mm foam with cloth upholstery
	Upholstery	Pile fabric/jekard 0.7-1.0 mm thickness
m	Area for seated passengers (sq.mm)	450*450
n	Area for standee passengers (sq.mm)	As per bus code
o	Number of seats including one for wheel chair	32 - 34
p	Number of standees (calculation as per AIS 052)	As per AIS 052
q	Sitting/Standing Ratio	Not required
r	Headrest	Required
s	Seats side facing location	Not suggested except on wheel arches
t	Seat arm	As per AIS 052
u	Magazine pouch	Required
v	Individual seat row fans	Required if ventilation provisions are inadequate in the event of AC failures
w	Reading lights individual	Required
x	Seat back rest	Reclining
y	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
z	Performance & strength requirements of driver & passenger seats	As per AIS 052
15.8.2	Gangway:	Minimum 600 mm
a	Minimum interior head room (centre line of gangway) mm	1900 including that in the rear overhang area.

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
i	At front axle:	As per AIS 052
ii	At rear axle:	As per AIS 052
iii	Other areas	As per AIS 052
b	Gangway width (mm) from gates to longitudinal space between seats (access to service doors)	Minimum 600 mm
	Gangway width (mm) in longitudinal space between seats	Minimum 600 mm
	Gangway width (mm) in longitudinal space between seats (rear of rear edge of the rear door in rear engine bus)	Minimum 600 mm
c	Slope of the gangway in type I ACX bus	As per AIS 052
	General	
	Gangway slope in zone rearward of a transverse vertical plane situated 1500 mm forward of the centre line of the rear axle	As per AIS 052
15.9	Driver's work place/cabin/seat etc	As per AIS 052
	Driver work place/cabin provided with more privacy, safety and easy access to controls and inter alia equipped with:	State of art driver cockpit station.
a	Reverse gear camera	As per ITS specifications
b	Door cameras	As per ITS specifications
c	Lights control	√
d	Fans and/or other means of ventilation & air circulation in the event of failure of AC	√

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
e	Driver's seat generally as per AIS 023 and duly equipped with	As per AIS 023 & AIS 052
i	Three way seat adjustments facility and controls	√
ii	Air suspension system	√
15.10	Corrosion prevention & painting	Corrosion prevention treatment/painting for structural members/components, assembled structure, panels etc
a	Corrosion prevention treatment	All materials & joints would withstand a two weeks (336 hours) salt spray test in accordance with ASTM procedure B117 with no structural detrimental effect to normally visible surfaces & no weight loss of over 1%. Other details As per AIS 052
	Internal surfaces of structural members	As above
	External surfaces of structural members	As above for internal surfaces of tubular structural members corrosion prevention
	After drilling holes/welding	As above for corrosion prevention if any riveting and or welding operations carried out after treatment , etc, corrosion free guaranteed life of bus items/structure in years/km
	Inter metallic galvanic corrosion prevention	Required
b	Primer coating	Suitable specification and performance
c	Painting	PU paint panel etch primer, PU primer surface, PU top coat BIS 13213:1991 or latest/international standard as applicable for exterior painting including interior wherever required. shades–IS 5-1978 (or latest) class-A2
16	Electricals	
16.1	Electrical Cables	BIS marked, copper conductors with fire retardant as per IS/ISO:6722:2006 as per appropriate class. conductor x-sec varying as per circuit requirements, minimum cross-section 0.5 sq mm. quality marking may also be as per equivalent or better European, Japanese, US standards

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
16.2	Conductor cross section	As above and suitable to carry rated current (Japanese Auto Standard JASO D0609-75 AV)
16.3	Safety requirements of electrical	As per AIS 052
a	Fuse	As per AIS 052 - fuse of rated current 1.5 times the load current of electrical equipment. Necessary in every electrical circuit
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	As per AIS 052. Isolation switch required for each such circuit
c	Location of cables away from heat sources	As per AIS 052- required for each such circuit
d	Type approval of circuit diagram as per standards related to electric equipments/wiring	As per AIS 052 - required for all items
e	Battery cut - off switch (isolator switch)	Heavy-duty type capable of carrying & interrupting total circuit load.1 each near battery/driver
16.4	Wind screen wiping & washing system, demister etc:	Pantograph type electrically operated with two wiper arms & blades; wiper motor heavy-duty steel body with minimum 2-speed operation; wiping system as per CMVR/BIS 7827 Part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011
a	Wiper motor	Variable speed with time delay relay as per IS011.20-24 cycles/sec, 24 V*150W minimum.
b	Wiper arm/blade	Pantograph type. AIS 019/AIS011
c	Wind screen washing system	√
d	Capacity of washing system tank litres minimum	10
16.5	Driver Cabin Fan	1 number, 200 mm fan. As per provision of CMVR, matching interiors
16.6	Lighting - internal & external and illumination	As per AIS 052
16.7	Illumination requirements/performance of:	

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
a	Dash board tell tale lighting/control lighting	As per AIS 052 & bulbs tested for photometry as per IS 1606:1996
b	Cabin lighting- luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of ≥ 100 lux & ≤ 200 lux
c	Passenger area lighting -luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of ≥ 100 lux and ≤ 150 lux
17	ITS	As specified separately under ITS specifications
18	Safety related items	
18.1	Driver seat belt & anchorage duly type approved	ELR recoil type, 3 point mounting as per CMVR & bus code. Conforming to AIS 005 & AIS 015
18.2	Passengers seat belt	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
	Number	
18.3	Driver/Passenger/Wheelchair seatbelt anchorage	
18.4	Fire extinguisher	Dry chemical powder type GSR– 853 (E) dated 19.11.2000 (or latest)/As per AIS 052, 2 kg each, ISI Marked
18.5	First aid box	1 Number, as per provision of CMVR
18.6	Handrails Minimum length*diameter*height above floor: mm	Colour contrasting and slip resistant of aluminium tubing. 32 mm diameter, 3 mm thick.
18.7	Handholds	Colour contrasting and slip resistant. 2 to 4 Numbers. Hand holds per bay. Other details as per AIS 052
18.8	Stanchions	Vertically fitted, aluminium tubing with Colour contrasting and slip resistant. 40 mm diameter & 3.15 mm thick. Other details as per AIS 052

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
18.9	Bells for Passenger convenience	High visibility bell pushes shall be fitted at a height of 1.2 meter on all alternate stanchions. These would assist PwDs	
18.10	Entrance/Exit Guard/Step well guard:	800 mm minimum height extending ≥ 100mm more than centre line of sitting position of the Passenger.	
18.11	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR	
18.12	Front/Rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008	
18.13	Mirrors right/left side exterior/interior	Convex As per AIS 001 & 002. Interior with double curvature	
18.14	Towing device front/rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus within 30^{o} of the longitudinal axis of the bus. As per CMVR & IS 9760 - Ring Type	
18.15	Warning triangle	As per AIS 052/CMVR	
18.16	Fog lighting	As per AIS 052/CMVR	
18.17	Bumpers - front and rear	Both made of steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system	
	Impact strength for bumpers	Meet requirements of Para 6.3.1 of AIS 052	
18.18	Gas leak detection system for CNG fuelled engines	√	√
18.19	Fire detection system	√	√
18.20	Fire suppression system	√	√
19	Miscellaneous items/requirements		
19.1	Windows		
a	Type of window	Large tinted window panes for ACX bus	
b	Minimum height of window aperture (clear vision)	≥ 1200 mm in type I -ACX	
c	Minimum height of upper edge of window aperture from bus floor	As per AIS 052	

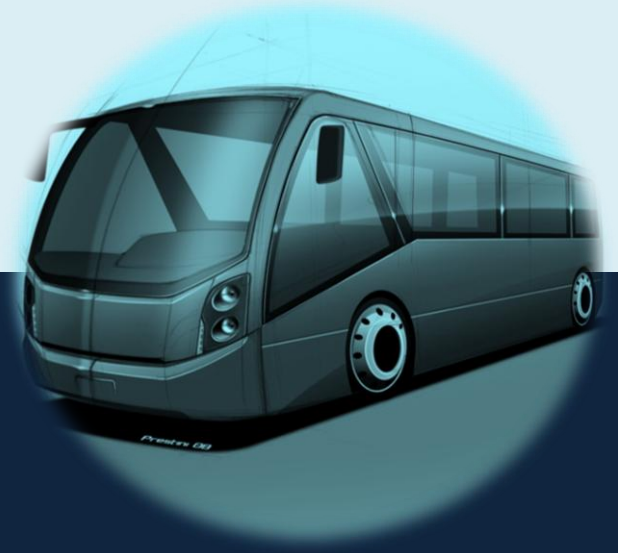
	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
d	Minimum width of windows (clear vision zone)	As per AIS 052
19.2	Cabin luggage carrier (CLC)	As per AIS 052
a	Positioning of CLC	
i	Width from side wall (mm)	250
ii	Height from roof (mm)	200
b	Design & material	"ABS (acrylonitrile butadiene styrene) ASTM-BS368/better or similar to that in Passenger aero planes
c	Additional provisions at the underside of CLC	√
i	Individual seat reading light	At the discretion of purchaser. Bus should be enabled
ii	Individually adjustable air conditioning knob	At the discretion of purchaser. Bus should be enabled
iii	Call button	At the discretion of purchaser. Bus should be enabled
19.3	Passenger entertainment and other miscellaneous items	
a	Touch screen setting type TV for individual seats	At the discretion of purchaser. Bus should be enabled
b	Audio ports at arm rest for TV and piped music	At the discretion of purchaser. Bus should be enabled
c	Head phone (replaceable loose item on demand)	At the discretion of purchaser. Bus should be enabled
d	Folding table for each seat	√
e	Magazine pouch	√
f	Adjustable foot rest	At the discretion of purchaser. Bus should be enabled
g	Back rest adjustment knob in case of reclining seats	√
h	Power ports on each seat to facilitate use of laptop, MP3 player, USB etc	√
i	Cluster of mobile phone charging points	√

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
20	Air conditioning system - operational conditions/other requirements etc.	
20.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature
20.2	Target results	a) 23+/- 1°C (for all temperature ranges) b) Minimum average air velocity at air vent is 4.5 m/s
20.3	Apparatus	Lab condition and heating chamber
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum) (for more than 42°C of saloon temperature, pull down time within 40 minutes (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers. at nose level
20.5	Air curtains on entry/exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding/alighting of Passenger with minimum air flow of 1000±50 m^3/hr at each gate	Optional
20.6	Individual seat air flow adjustment system	Required
20.7	Air conditioning system in driver work place	As in saloon
21	Noise, vibration and harshness (NVH) levels (interior)	
21.1	Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)-test procedure as per AIS 020	≤ 75 Db(A) (to be achieved a maximum noise level of 72 Db(A) from 1st April 2015 onwards)
21.2	Vibration levels	

	Bus specifications for Standard Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
a	Vibration levels at driver/Passenger seats (meter/sec^2)	≤ 0.5
b	Vibration level in gangway (meter/sec^2)	≤ 1
21.3	Harshness levels when measured under city driving conditions on city roads with pot holes and speed breakers, etc	
a	Noise level in saloon from drive axle, etc	Nil
b	Dominant frequencies to fall outside the ranges of	0.5-1 Hz, 5-7 Hz and 18-20 Hz
c	Transient vibration level in seating area maximum	1g
d	Transient vibration level at driver seat maximum	0.1g
22	Life cycle requirements of bus (whichever is earlier)	15 years or 12,00,000 km

Chapter - 07

Specifications for Midi bus of Premium segment



	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
	Bus floor heights	As per AIS 052 (this segment of buses are envisaged to be more comfortable for seating passengers with lesser standees). However all buses to be delivered after 1st April 2015 will follow the same definition as in the case of non-premium buses) i.e. "low floor area shall not be less than 50% of the total saloon area (excluding front wheel boxes and driver's cab) and shall not be ramped in the longitudinal plane"
1	Propulsion system	Internal combustion engine, electrical, hybrid, fuel cell
2	Fuels-options	Diesel/CNG/ULSD/hydrogen
3	Engine	
3.1	Fuel recommended	Fuel to be compatible with propulsion system
3.2	Engine HP sufficient to provide:	
a	Rated performance at GVW in a stop/start urban operations	Maximum vehicle speed of up to 75 kmph bus GVW
b	Acceleration (meter/sec²) complemented with minimum 1000 Nm torque	0.9
c	Attain bus speed of 0-30 kmph	9.0 seconds
d	Max speed	≤ 75 kmph
e	Grade ability from stop at 1.5 GVW (%)	17
f	Rated HP/torque preferably at lower rpm range	HP rating designed to provide rated torque of minimum 1000 Nm (under full load) preferably at lower rpm range.
3.3	Maximum fuel efficiency kmpl or kmpkg. Vehicle Manufacturer to specify fuel efficiency in terms of kmpl or kmpkg under standard 13 mode urban operating cycle and rated loading. While tendering, purchaser may take into account the higher weight age for more fuel efficient vehicle	√
3.4	Emission norms	BS III/BS IV or latest as applicable

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
3.5	Electronic engine management (EMS) system with following provisions amongst others:	Full electronic management of engine including on-board diagnostic and driver alerts e.g. engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, diagnostic details message (engine specific)
a	Fault tracing and diagnostics	√
b	Information generation about driver and vehicle performance as specified as part of ITS specifications	√
3.5.1	Typical EMS parameters	√
a	Fuel feed & fuel delivery system status related to:	√
i	Feed pump pressure	√
ii	Fuel delivery pressure	√
iii	Booster pressure and temperature	√
b	Coolant Status related to:	√
i	Coolant level	√
ii	Coolant temperature	√
iii	Coolant pressure	√
c	Engine oil status related to:	√
i	Oil level	√
ii	Oil temperature	√
iii	Oil pressure	√
d	Accelerator pedal position	√
e	Water in fuel indicator	√
f	Injector status	√
g	Engine position timing sensor	√
h	Engine speed sensor	√
i	Control and information links	√

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
i	SAE J1939 control link	√	
ii	SAE J1587 / J1708 Information link	√	
3.6	Engine operational requirements	√	
3.7	Engine location	Rear	
3.8	Transmission-heavy duty-		
	Automatic with torque convertor and in-built retarder - hydrodynamic type. Neutral during stops. Reduced engine load at stops (NBS)	√	
4	Operational safety - transmission related		
4.1	Reverse gear engagement	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)	
4.2	An interlock to prevent the movement of bus when doors opened	√	
4.3	Drive shaft lubrication for life	√	
5	Clutch	Not applicable	
6	Steering system	Hydraulic power steering with height and angle adjustments provision. Adjustable steering column.	
7	Suspension system	Fully pneumatic complete with ECAS/electronic management and control systems	
7.1	Front	Air bellows - 2 numbers	
7.2	Rear	Air bellows – 2/4 numbers	
7.3	Kneeling (mm)	60 mm entry/exit side severally & collectively	
7.4	An interlock to prevent movement of bus when kneeled/kneeling	√	√

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
7.5	Anti roll bars/stabilizers[1]	Both front and rear
7.6	Shock absorbers	Hydraulic double acting 2 at front & 2/4 at rear
7.7	Controls	Electronically controlled air suspension or superior system
a	Electronic control suspension system for:	√
b	Controlling floor level	√
c	Enhancing comfort by absorbing shocks in case of road irregularities	√
d	Uniform spring rate in all loading conditions	√
e	Self correction of bellow height to:	√
i	Help protect driveline angularity related problems	√
ii	Counter road unevenness	√
iii	Monitor bellow failures	√
iv	Provide passenger comfort	√
8	Braking System	Dual circuit full air brakes, with disc type arrangement for front and rear brakes. Full pneumatic electronically controlled disc brakes with brake blending and rollback prevention system. Graduated hand controlled, spring actuated parking brakes acting on rear wheels.
8.1	Anti skid anti brake locking system (ABS) necessary for urban driving cycle: i) involving high levels of unexpected braking requirements, ii) calling for excessive panic braking particularly in rainy season. iii) Requiring enhanced manoeuvrability, smooth stopping and low wear and tear of involved components.	√

[1] Optional in case of independent suspension

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
8.2	Electronic braking control system (EBS) for uniform distribution of braking force on all wheels, contributing to smooth braking, optimizing braking with minimal pedal force thereby reducing driver fatigue.	√
8.3	Electronic monitoring of brakes	
a	Brake pad condition	√
b	Brake pad temperature condition	√
9	Electrical system	24 volt DC
9.1	Batteries:	Low maintenance type lead acid batteries for 24 V system- performances as per BIS: 14257-1995 (latest). 2*12V batteries of 180 Ah capacity. Maintenance free batteries preferred
9.2	Self starter	24V
9.3	Alternator	24V- another alternator of similar capacity for AC.
9.4	Electrical wiring & controls- type	As specified separately under ITS specifications
10	Speed limiting device (optional)	Electronic type duly approved/certified as per AIS: 018/2001 or latest, tamper proof and be adjusted to applicable speed limit
11	Tyres	Steel radial tube-less. Size and performance as per CMVR
12	Fuel tank	On-board fuel storage capacity adequate for bus operation of over 250 km between consecutive fillings
	Fuel tank location	Optional
13	Bus characteristics	
13.1	Bus dimensions mm	
a	Overall length (over body excluding bumper) in mm	≤ 9400
b	Overall width (sole bar/floor level- extreme points) in mm	2600 (maximum)

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
c	Overall height (unladen)-(at extreme point)	3800(maximum)
d	Wheel-base	≤ 5000
e	Front overhang in mm	As per CMVR
f	Rear overhang	As per CMVR
13.2	Turning circle radius (mm)-maximum 10 meters	As per CMVR
13.3	Floor height above ground (mm)	≤ 900
13.4	Clearances (mm)	
a	Axle clearance (mm)	Minimum190
b	Minimum ground clearance (un-kneeled) at GVW	Within the wheelbase not less than 240 mm.
13.5	Angles (degrees)	
a	Angle of approach (unladen)	$\geq 8.0^{o}$
b	Angle of departure (unladen)	$\geq 8.5^{o}$
c	Ramp over angle (half of break-over angle)	$\geq 4.8^{o}$
14	Bus body	
14.1	Location of gates	Location on near side
14.2	Type of doors	Swing in/out type
a	Operating mechanism	Electro pneumatically controlled
b	Opening closing time in seconds per operation	≤ 4
c	Positions of door controls ensuring display of open/close status on dash board	On dashboard, as also inside & outside of doors for emergency operation and at stanchions for Passenger access
d	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory
14.3	Front service doors - near side:	√
a	Door aperture (without flaps) in mm	As per AIS 052

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
b	Clear door width (fully opened) in mm	As per AIS 052	
c	Door height in mm	As per AIS 052	
d	Positioning front service gate	As per AIS 052	
e	Number of gates	1	
14.4	Rear service doors (near side):	Optional	
a	Door aperture (without flaps) in mm	As per AIS 052	
b	Clear door width (fully opened) in mm	As per AIS 052	
c	Door height in mm	As per AIS 052	
d	Positioning rear door	Preferably rear edge of gate 1500 mm ahead of central line of rear axle or front edge of gate 1500 mm behind central line of rear axle	
e	Number of gates	1	
14.5	Maximum first step height(mm) from ground - unladen & un-kneeled position in buses with:		
a	Stepped type entry	400	
14.6	Maximum height (mm) of other steps		
a	if door ahead of rear axle	250	
b	if door behind rear axle	NA	
14.7	Ramp for wheel chair at the gates	Sunken type wrap over (manually operated) ramp, for wheel chair of PwDs, fitted on floor at gate (preferably at front gate) in front of PwD seat anchorage.	Suitable design mechanism for > 400mm floor ht considering that floor level of bus stops are at 400mm
a	Dimensions	Width ≥ 900 mm	
b	Material	Aluminium alloy with anti-slip coating	
c	Load carrying capacity	> 300 kg	

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200mm	√	
e	Device to lock wrapped up ramp	√	
f	Kneel ramp control	Kneeling arrangement for kneeling on left side severally and combined. Kneeling up to 60mm	
g	Requirement for passenger with limited mobility	√	
h	Wheel chair anchoring- minimum for one wheel chair	√	
i	Priority seats- minimum 2 seats	√	
j	Stop request- on every pillar	√	
k	Place to keep PwD assists like cane, etc	√	
l	Colour contrasting/other guidance for persons with visual deficiencies	√	
m	Any other provisions to meet requirement of disabilities Act 1995	√	
14.8	Emergency doors/exits or apertures (numbers)	As per AIS 052	
	Dimensions mm	As per AIS 052	
14.9	Door closing requirements for bus movement -	Bus could move only after door closing completed	
a	Power operated service door - construction & control system of a power operated service door be such that a Passenger is unlikely to be injured/trapped between the doors while closing.	As per AIS 052	
b	Door components	As per AIS 052	
c	Door locks/locking systems/door retention items	As per AIS 052	
d	Door hinges	As per AIS 052	

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
15	Bus body		
15.1	Design type approval		
a	Design type approval- all bus body structures & structural aggregates be designed to fulfil the loading, operating & performance parameters using finite element analysis or any other analytic technique for: Strength Stiffness Structural Stability Vibration Safety	Required	
15.2	Structural performance		
a	Bus structure to meet requirements of:		
i	Body structure strength test- each type of vehicle be subjected to roll over test on complete vehicle/specified representative section thereof or to an alternate method approved by the test agency	As per AIS 052	
ii	Stability	As per AIS 052	
iii	Deflection	√	
iv	Vibrations	√	
v	Roll over protection	√	
vi	Safety	√	

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
vii	Joint strength- body panel joints meet requirements of holding the joined panel when subjected to force of 60% of tensile strength of weakest joined body panel.	As per AIS 052
b	Various loads:	
i	Normal loads (static) = Number of Passenger*weight of Passenger (68 Kgs.) + Passenger luggage weight (7 Kgs). (Besides the vehicle related loads).	√
ii	Bump loads: # Bump height = As per relevant BIS/Indian Road Congress guidelines. # Case I: single wheel on bump/pot hole. # Case II: diagonally opposite wheels on Bump/Pot hole. # Case III: both wheels (front & rear) on bump/pot hole.	√
iii	Braking loads: 0.6g (applied together). Horizontal = 0.6g load, Vertical = 1g load	√
c	Bus body structure evaluation	As under
i	Physical testing or	As per AIS 052
ii	Finite element method	As per AIS 052
d	Required performance values/data (minimum) for above load conditions:	As under
i	Strength (factor of safety) (tolerance -10%)	≥ 3 i.e. design stress ≥ 1/3rd of yield stress
ii	Stiffness (deflection) mm	5mm
iii	Vibrations (lowest natural frequency) hertz	5Hz

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
iv	Roll over tests with the bus rolling from ground level instead of a raised platform. Angular velocity should not exceed 5 degrees/sec. All other procedure as per AIS031	(i) Unstable position should not occur before 35^0. (ii) No part of structure intrudes into residual space.
	1 Bus tilted to its unstable position	
	2. Bus allowed falling freely under gravity from this position.	
	3. GVW of the bus to be considered	
v	4. Energy absorbed by the structure {E_R =Reference energy-- potential energy of the bus in its (unstable) equilibrium position). ER = M*g*h Where M= Effective weight of the bus, g = Acceleration due to gravity, h= height of C.G. above ground level in (unstable) equilibrium position.}.	0.75 ER
vi	Buckling factor	≥ 4
15.3	Bus structure- materials specifications etc	
a	Super structure	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated above
b	Under structure:	
c	Panelling	
i	Roof panelling: interior	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated above
ii	Roof panelling: exterior	
iii	Side panelling: interior	
iv	Other side panels:	

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
v	Stretch panel: Exterior side panels of stretched steel sheet at different waist levels along length of the bus	
vi	Skirt panel	
vii	Front end interior	
viii	Front end exterior	
ix	Rear end interior	
x	Rear end exterior	
15.4	Insulation	Material to be decided by the manufacturer subject to meeting requirement of flame retardancy, fire proofing and non-in flammability as per applicable standards
a	Roof structure	Flame retardant/non flammable-- polyurethane/glass wool IS 15061or latest of density 40 Kg/m3 minimum.
b	Engine compartment	Fire retardant preferably ceramic fibre 128 kg/m3
15.5	Aluminium extruded sections for:	
a	Rub rail	Aluminium extrusion IS 733/1983 or better
b	Decorative moulding	
c	Wire cover	
d	Wearing strip	
e	Foot step edging	
f	Panel beading	
g	Window frame	
h	Roof grab rail brackets	
15.6	Floor type/Materials etc	
a	Type of floor	Flat except at wheel arches in the low floor area of bus- seats may be located over the wheel arches

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
b	Steps on floor	For 400 mm floor height: no steps except those necessary for the rear high floor area	For higher floor height: steps in the low floor area either at gates or across the floor. Steps may be provided as necessary on high floor in the rear side
c	Maximum floor slope	6 %	
d	Floor surface material	12 mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gms/cc conforming to IS 3513 (Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS 710-1976/ latest and fire retardant as per BIS 5509-2000 (IS 15061:2002)	
e	Anti – skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy	
15.7	Safety glasses and fittings:	Single piece windshield, stylish exterior, combination head lamps etc	
a	Front windscreen (laminated) glass:	Single piece laminated safety glass, with PVB film IS 2553 (Part-2)-1992/latest. Front wind screen glass shape may be curved or plain, flat with curved corners, to match vehicle design and contours etc.	
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
b	Rear windscreen: (wherever provided)	Single piece curved or plain/flat/curved at centre & curved at corners to match vehicle contours/design. Rear wind screen glass be toughened glass IS 2553(Part-2)–1992/latest.	
	Size:	Standard designs for each variant of buses to be followed. (Refer Annexure 1)	
c	Side windows:	Large flat/curved to match bus shape and contour, 1-piece design-fixed toughened glass IS2553 (Part-2)-1992/latest.	
	Glass thickness:	4.8-5.3mm	

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
	Minimum window glass/aperture area (main windows) cm^2	>10000
	Light transmission (%) in case of tinted glasses	As per CMVR
d	Window & other glasses - material specs, thickness etc	Tinted and toughened as per IS 2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness
e	Safety glass	As per bus code AIS 052/CMVR
f	Rear view mirrors	As per bus code AIS 052
15.8	Seating and gangway etc for ACX buses generally as per AIS 052	Ergonomically designed seats with soft cushion head seats rest, spacious gangway etc.
15.8.1	Passenger seating's for ACX type-1 buses	As per bus code AIS 052
a	Seat layout in the low floor area	2x2
b	Seat layout in the higher floor area	2x2
c	Seat area/seat space per Passenger (width*depth) mm as per AIS 052	450*450
d	Seat pitch - minimum: mm as per AIS 052	750
e	Minimum backrest height -from floor to top of seat/headrest	1100 mm from floor as per AIS 052
	Seat base height- distance from floor to horizontal front upper surface of seat cushion mm	As per AIS 052
f	Torso angle	Minimum 15^0 with option of reclining adjustable seats
g	Passenger seats with high back rest, contoured to suit human body, padded and provided with head rest	√
h	Seat materials	Cushioned seats with polyurethane foam as per IS15961-2002.
i	Seat frame structure material where required	Frame structure of ERW steel or aluminium tubes/sheets/formed sections
j	Free height over seating position mm	More than 900

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
	Seat base height	As per AIS 052
k	Clearance space for seated Passenger facing partition mm	As per AIS 052
l	Seat back/Pad material/thickness:	Polyurethane foam IS15061:2002, 50± 5 mm
	Type	Suitably moulded/fabricated and padded with > 50 mm foam with cloth upholstery
	Upholstery	Pile fabric/jekard 0.7-1.0 mm thickness
m	Area for seated passengers (sq.mm)	450*450
n	Area for standee passengers (sq.mm)	As per AIS 052
o	Number of seats including one for wheel chair	23- 34
p	Number of standees (calculation as per AIS 052)	As per AIS 052
q	Sitting/Standing ratio	Not required
r	Headrest	Required
s	Seats side facing location	Not suggested except on wheel arches
t	Seat arm	As per AIS 052
u	Magazine pouch	Required
v	Individual seat row fans	Required if ventilation provisions are inadequate in the event of AC failures
w	Reading lights individual	Required
x	Seat back rest	Reclining
y	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
z	Performance & strength requirements of:	√
i	Driver seat (fully air suspended)	AIS 023
ii	Passenger seats	AIS 023
15.8.2	Gangway:	Minimum 600 mm

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
a	Minimum interior head room (centre line of gangway) mm	1900 including that in the rear overhang area.
i	At front axle:	As per AIS 052
ii	At rear axle:	As per AIS 052
iii	Other areas	As per AIS 052
b	Gangway width (mm) from gates to longitudinal space between seats (access to service doors)	Minimum 600 mm
c	Gangway width (mm) in longitudinal space between seats	Minimum 600 mm
d	Gangway width (mm) in longitudinal space between seats (rear of rear edge of the rear door in rear engine bus)	Minimum 600 mm
e	Slope of the gangway	As per AIS 052
	General	
	Gangway slope in zone rearward of a transverse vertical plane situated 1500 mm forward of the centre line of the rear axle	As per AIS 052
15.9	Driver's work place/cabin/seat etc	As per AIS 052
	Driver work place/cabin provided with more privacy, safety and easy access to controls and inter alia equipped with:	State of art driver cockpit station.
a	Reverse gear camera	As per ITS specifications
b	Door cameras, as specified as part of ITS specifications	As per ITS specifications
c	Lights control	√

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
d	Fans and/or other means of ventilation & air circulation in the event of failure of AC	√
e	Driver's seat generally as per AIS 023 and duly equipped with	AIS 023 & AIS 052
i	Three way seat adjustments facility and controls	√
ii	Air suspension system	√
15.10	Corrosion prevention & painting	Corrosion prevention treatment/painting for structural members/components, assembled structure, panels etc
a	Corrosion prevention treatment	All materials & joints would withstand a two weeks (336 hours) salt spray test in accordance with ASTM procedure B117 with no structural detrimental effect to normally visible surfaces & no weight loss of over 1%. Other details as per AIS 052
	Internal surfaces of structural members	As above
	External surfaces of structural members	As above for internal surfaces of tubular structural members corrosion prevention
	After drilling holes/welding	As above for corrosion prevention if any riveting and or welding operations carried out after treatment , etc, corrosion free guaranteed life of bus items/structure in years/km
	Inter metallic galvanic corrosion prevention	Required
b	Primer coating	Suitable specification and performance
c	Painting	PU paint panel etch primer, PU primer surface, PU top coat BIS 13213:1991 or latest/international standard as applicable for exterior painting including interior wherever required. shades–IS 5-1978 (or latest) class-A2
16	Electricals	
16.1	Electrical cables	BIS marked, copper conductors with fire retardant as per IS/ISO:6722:2006 as per appropriate class. conductor x-sec varying as per circuit requirements, minimum cross-section 0.5 sq mm. quality marking may also be as per equivalent or better European, Japanese, US standards

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
16.2	Conductor cross section	As above and suitable to carry rated current (Japanese Auto standard JASO D0609-75 AV)
16.3	Safety requirements of electrical	As per AIS 052
a	Fuse	As per AIS 052 - fuse of rated current 1.5 times the load current of electrical equipment. Necessary in every electrical circuit
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	As per AIS 052. Isolation switch required for each such circuit
c	Location of cables away from heat sources	As per AIS 052- required for each such circuit
d	Type approval of circuit diagram as per standards related to electric equipments/wiring	As per AIS 052 - required for all items
e	Battery cut - off switch (isolator switch):	Heavy-duty type capable of carrying & interrupting total circuit load. One each near battery/driver
16.4	Wind screen wiping & washing system, demister etc:	Pantograph type electrically operated with two wiper arms & blades; wiper motor heavy-duty steel body with minimum 2-speed operation; wiping system as per CMVR/BIS 7827 Part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011
a	Wiper motor	Variable speed with time delay relay as per IS011.20-24 cycles/sec, 24 V*150W minimum.
b	Wiper arm/blade	Pantograph type. AIS 019/AIS011
c	Wind screen washing system	√
d	Capacity of washing system tank litres minimum	10
16.5	Driver Cabin Fan	1 number, 200 mm fan. As per provision of CMVR, matching interiors
16.6	Lighting - internal & external and illumination	As per AIS 052
16.7	Illumination requirements/performance of:	
a	Dash board tell tale lighting/control lighting	As per AIS 052 & bulbs tested for photometry as per IS 1606:1996
b	Cabin lighting- luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of ≥ 100 lux & ≤ 200 lux

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
c	Passenger area lighting -luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of ≥ 100 lux and ≤ 150 lux
17	ITS	As specified separately under ITS specifications
18	Safety related items	
18.1	Driver seat belt & anchorage duly type approved.	ELR recoil type, 3 point mounting as per CMVR & bus code. Conforming to AIS: 005 & 015.
18.2	Passengers seat belt	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
	Number	
18.3	Driver/Passenger/Wheelchair seatbelt anchorage	
18.4	Fire extinguisher	Dry chemical powder type GSR– 853 (E) dated 19.11.2000 (or latest)/As per AIS 052, 2 kg each, ISI Marked
18.5	First aid box	1 Number, as per provision of CMVR
18.6	Handrails minimum length*diameter*height above floor in mm	Colour contrasting and slip resistant of aluminium tubing. 32 mm diameter, 3 mm thick.
18.7	Handholds	Colour contrasting and slip resistant. 2 to 4 Numbers. Hand holds per bay. Other details as per AIS 052
18.8	Stanchions	Vertically fitted, aluminium tubing with colour contrasting and slip resistant. 40 mm diameter & 3.15 mm thick. Other details as per AIS 052
18.9	Bells for Passenger convenience	High visibility bell pushes shall be fitted at a height of 1.2 meter on all alternate stanchions. These would assist PwDs
18.10	Entrance/Exit guard/Step well guard	800 mm minimum height extending ≥ 100 mm more than centre line of sitting position of the Passenger.
18.11	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR
18.12	Front/Rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008
18.13	Mirrors right/left side exterior/interior:	Convex as per AIS 001 & 002. Interior with double curvature
18.14	Towing device front / rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus within 30^{o} of the

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		longitudinal axis of the bus. As per CMVR & IS 9760 - Ring Type
18.15	Warning triangle	As per AIS 052/CMVR
18.16	Fog lighting	As per AIS 052/CMVR
18.17	Bumpers - front and rear	Both made of steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system
	Impact strength for bumpers	Meet requirements of Para 6.3.1 of AIS 052
18.18	Gas leak detection system for CNG fuelled engines	√
18.19	Fire detection system	√
18.20	Fire suppression system	√
19	Miscellaneous items/requirements	
19.1	Windows	
a	Type of window	Large tinted window panes for ACX bus
b	Minimum height of window aperture (clear vision) in mm	≥ 700 mm in type I -ACX
c	Minimum height of upper edge of window aperture from bus floor in mm	As per AIS 052
d	Minimum width of windows (clear vision zone) in mm	As per AIS 052
19.2	Cabin luggage carrier (CLC)	As per AIS 052
a	Positioning of CLC :	
i	Width from side wall in mm	250
ii	Height from roof in mm	200
b	Design & material	"ABS (acrylonitrile butadiene styrene) ASTM-BS368/better or similar to that in Passenger aero planes
c	Additional provisions at the underside of CLC:-	√

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
i	Individual seat reading light	At the discretion of purchaser. Bus should be enabled
ii	Individually adjustable air conditioning knob	At the discretion of purchaser. Bus should be enabled
iii	Call button	At the discretion of purchaser. Bus should be enabled
19.3	Passenger entertainment and other miscellaneous items	
a	Touch screen setting type TV for individual seats	At the discretion of purchaser. Bus should be enabled
b	Audio ports at arm rest for TV and piped music	At the discretion of purchaser. Bus should be enabled
c	Head phone (replaceable loose item on demand)	At the discretion of purchaser. Bus should be enabled
d	Folding table for each seat	√
e	Magazine pouch	√
f	Adjustable foot rest	At the discretion of purchaser. Bus should be enabled
g	Back rest adjustment knob in case of reclining seats	√
h	Power ports on each seat to facilitate use of laptop, MP3 player, USB etc	√
i	Cluster of mobile phone charging points	√
20	Air conditioning system - operational conditions/other requirements etc.	
20.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature
20.2	Target results	a) 23±1°C (for all temperature ranges) b) Minimum average air velocity at air vent is 4.5 m/s
20.3	Apparatus	Lab condition and heating chamber
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum) (for more than 42°C of saloon temperature, pull down time within 40 minutes (maximum))

	Bus specifications for Midi Bus of Premium Segment (Air conditioned)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		4. Thermocouple to be placed over place minimum 20 numbers. at nose level
20.5	Air curtains on entry/exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding/alighting of Passenger with minimum air flow of 1000±50 m^3/hr at each gate	Optional
20.6	Individual seat air flow adjustment system	Required
20.7	Air conditioning system in driver work place	As in saloon
21	Noise, vibration and harshness (NVH) levels (interior)	
21.1	Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)-test procedure as per AIS020	≤ 75 Db(A) (to be achieved a maximum noise level of 72 Db(A) from 1st April 2015 onwards)
21.2	Vibration levels	
a	Vibration levels at driver/Passenger seats m/s^2	≤ 0.5
b	Vibration level in gangway (m/s^2)	≤ 1
21.3	Harshness levels when measured under city driving conditions on city roads with pot holes and speed breakers, etc	
a	Noise level in saloon from drive axle, etc	Nil
b	Dominant frequencies to fall outside the ranges of	0.5-1 Hz, 5-7 Hz and 18-20 Hz
c	Transient vibration level in seating area maximum	1g
d	Transient vibration level at driver seat maximum	0.1g
22	Life cycle requirements of bus (whichever is earlier)	15 years or 12,00,000 km

Chapter - 08

Specifications for Articulated BRT bus for guidance

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
	Definition of Floor area	Floor height shall be uniform inside the vehicle
1	Propulsion system	ICE. electrical, hybrid, fuel cell
2	Fuel-options	Fuel to be compatible with propulsion system & prescribed emission norms
3	Engine	
3.1	Engine HP sufficient to provide:	
a	Rated performance at GVW in a stop/start urban operations	Geared maximum speed without speed limiter to be 75 kmph
b	Acceleration (meter/sec^2)	≥ 0.8
c	Attain bus speed of 0-30 kmph in seconds	≤ 10.5
d	Maximum speed	Geared maximum speed without speed limiter to be 75 kmph
e	Grade ability from stop at GVW	17%
f	Rated HP/torque preferably at lower rpm range	Maximum engine torque required at lower range of RPM and spread over a wider range of RPM
g	Power requirements for Air conditioning system, ITS, etc	Required
3.2	Emission norms	BS III/BS IV or latest as applicable
3.3	Engine management	Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, diagnostic details message (engine specific)
3.4	Engine operational requirements	Engine should be able to operate efficiently at ambient temperatures of approximately 0^0C to 50^0C, humidity level from 5% to 100%, and altitude levels of up to 2000 meters, generally operating in the semi arid zone/hilly region prevailing in the area.
3.5	Engine location	Front in the tractor module and rear in the trailer module of articulated bus
3.6	Transmission	Purchasers to select any one transmission system.
a	Automatic with torque convertor. Neutral during stops	

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
b	Automated manual	
4	Operational safety	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)
5	Clutch (where applicable)	Dry, single plate, power assisted operation
5.1	Rear axle	Heavy duty rigid axle
5.2	Front axle	Heavy duty reverse Elliot type axle suitable the floor height of the bus
5.3	Rear middle axle – the drive axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations
6	Steering system	Hydraulic power steering with height and angle adjustment
7	Suspension system	Pneumatic
7.1	Front	Air bellows - 2 numbers.
7.2	Rear	Air bellows - 4 numbers.
7.3	Rear middle axle - the drive axle	Air bellows - 4 numbers.
7.4	Applicable for bi-articulated	
7.5	Applicable for bi-articulated	
7.6	Kneeling (mm)	Minimum 60mm entry/exit side severally & collectively in mixed traffic on direct routes
7.7	Anti roll bars/stabilizers	Rear middle, rear and Front
7.8	Shock absorbers	Hydraulic double acting at all axles
7.9	Controls (optional)	Electronically controlled air suspension or superior system
a	Applicable for bi-articulated	
b	Applicable for bi-articulated	
c	Applicable for bi-articulated	
d	Applicable for bi-articulated	

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
8	Braking system	Dual circuit full air brakes, with preferably disc type arrangement for front and drum at rear brakes. Graduated hand controlled, spring actuated parking brakes acting on rear wheels (any bus delivered after 1st April, 2015 will mandatorily have disc brake in front)
8.1	Anti skid anti brake locking system (ABS)	As per CMVR
8.2	Electronic controls	Required
8.3	Applicable for bi-articulated	
a	Applicable for bi-articulated	
b	Applicable for bi-articulated	
c	Applicable for bi-articulated	
9	Electrical system	24 volt DC
9.1	Batteries	Low maintenance type lead acid batteries for 24 V system- performances as per BIS 14257-1995 (latest). 2*12V of commensurate capacity. Maintenance free batteries preferred.
9.2	Self starter	24V
9.3	Alternator	24V (another alternator of similar capacity for AC buses)
9.4	Electrical wiring & controls -type	As specified separately under ITS specifications
10	Speed limiting device (optional)	Electronic type duly approved/certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit
11	Tyres	Steel radial tube-less. Size and performance as per CMVR
12	Fuel tank	Capable to enable bus operation ≥ 300 km between consecutive fillings
	Fuel tank location	Optional
13	Bus characteristics	
13.1	Bus dimensions in mm	
a	Overall length (over body excluding bumper) in	18000 (Minus tolerance -500)

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
	mm	
b	Overall width (sole bar/floor level- extreme points) in mm	2600 (maximum)
c	Overall height (unladen)-(at extreme point) in mm	3800 (maximum)
d	Wheel-base	
i	Tractor	6100 (-200 + 400 mm tolerance)
ii	Trailer: rear middle axle to rear axle	7000 (-100 mm +200 mm as tolerance)
iii	Applicable for bi-articulated	
e	Front overhang	As per CMVR
f	Rear overhang of trailer	As per CMVR
13.2	Maximum turning circle radius (mm)	As per CMVR
13.3	Floor height above ground (mm)	Maximum 900 with tolerance ± 20
13.4	Clearances (mm)	
a	Axle clearance (mm)	Minimum.190 mm
b	Wheel area clearance (mm)	> 220 mm for parts fixed to bus body & > 170 mm for the parts moving vertically with axle.
c	Minimum ground clearance (un-kneeled) at GVW	Within the wheelbase not less than 240 mm.
13.5	Angles (degrees)	
a	Angle of approach (unladen)	Not less than 8.5^0
b	Angle of departure (unladen)	Not less than 9.0^0
c	Ramp over angle (half of break-over angle)	Not less than 4.8°
13.6	Bus articulation system – for puller/pusher type articulated bus	
a	Bus articulation system - general requirements	Heavy-duty articulation system

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
		Suitable for vehicles with higher axle loads
		Simple and clearly defined connection surfaces
		Problem-free fitting to front and rear vehicle segments
		Nearly maintenance free
		Robust with low sensitivity to dirt and soiling
		Easy accessibility to sub systems for maintenance/replacement
		Fitted with an electronic control system that detects the driving situation
		Suitable mechanism for anti-jack - knife joint required
		Controls driving performance and also conducts a system diagnosis for early detection of any defects.
		Interconnecting unit design to prevent separation of tractor & trailer units even in an accident with another vehicle required
		Fitting with an electronic control system that detect the driving situation, identify faults and warns for a corrective action
b	Turn table	Robust design, suitable for puller/pusher type articulated bus; Suitable mechanism to minimize honing of floor edges/prevent tripping hazard
c	Horizontal articulation along longitudinal axis	$\pm 50^0$ with 2^0 tolerance
d	Vertical articulation along transverse axis	$\pm 10^0$ with 1^0 tolerance
e	Dampers	An integrated sensor mechanism enabling continuous monitoring of the defined damper values.
		The system to ensure a minimum damping, even on failure of the electronic components.
		2 - stage damping system may be considered as an optional system
f	Bellows	The bellows completely enclosing the gangway is closed under the articulation.
		Material for the folding bellows - synthetic rubber coated polyester material

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
		made up of three layers of synthetic rubber and two layers of polyester mats. The material sewn together and the outside seams crimped with an aluminium reinforcement profile to give the bellows structural stiffness.
		An aluminium J shaped extrusion bent to follow the contour of the bus body with a gap under the articulated joint may be riveted to the bus body end. The folding bellow collar may be fixed into this J section with a seal and the bellows be held to the bus body by tensioning the cable.
		A typical bus bellows installation would have two bellows that are connected to a centre hoop located in the centre of the articulation. This centre hoop manufactured from an aluminium extrusion forms to provide seating for the collar of the bellows and its seal. This hoop may be steered by a pantograph steering system that position the centre hoop so that it halves both the horizontal articulation angle (52° maximum) and the vertical articulation angle (11^0 maximum)
14	Bus gates/ Doors	
14.1	Type of doors	Double jack knife on near side (non- driver side) and on off side (driver side)
a	Operating mechanism	Electro pneumatically controlled
b	Opening/Closing time in seconds per operation (maximum)	4
c	Positions of door controls	On dashboard, as also Inside & outside of doors
d	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory
14.2	Front service doors; refer A - figure 4 (near side/non-driver side)- no station platform; steps required at door	Required

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
a	Door aperture (without flaps) in mm	800 (minimum)
b	Clear door width (fully opened) in mm	650 ± 50
c	Door height	1900 (minimum)
d	Positioning front service gate	Ahead of front axle
e	Number of gates	1
14.3	Tractor- entry/exit gate; refer B - figure 4 (near side/non -driver side) location	Door & steps optional - Purchaser/operator to decide
a	Door aperture (without flaps) in mm	1200 (min)
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Fixed partition between gates - full height	Optional (Purchaser to decide)
	Width of partition mm	400 (maximum)
	Location of partition	Vertical centre line of tractor partition or door aperture (when no partition) maximum 6500 mm and minimum 5600 from the front edge of bus (purchaser/operator to specify preferred distance as per their BRT facility)
e	Positioning doors with respect to partition.	One on each side of the partition
f	Distance between tractor and trailer entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
g	Number of gates	2
14.4	Trailer (near side/non driver side)	
14.4.1	Trailer: entry exit gates with doors; refer C - figure 4-ahead of rear axle (near side/non-driver side)	Option one door & steps optional - purchaser/operator to decide option one or two or three
a	Door aperture (without flaps) in mm	800
b	Clear door width (fully opened) in mm	650 ± 50
c	Door height in mm	1900 (minimum)

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
d	Fixed partition between gates- full height	Optional (Purchaser to decide)
	Width of partition in mm	400 mm maximum
	Location of partition	Centre line of partition of tractor to centre line of door aperture of trailer- 6500 mm
e	Positioning doors with respect to partition	One on each side of the partition
f	Distance between tractor and trailer entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
g	Number of gates	2
14.4.2	Trailer: entry exit gates with doors; refer C - figure 4-ahead of rear axle (near side/non-driver side)	Option two door & steps optional- purchaser/operator to decide option one or two or three
a	Door aperture in mm	1500
b	Clear door width (fully opened) in mm	1300 ± 50 maximum
c	Door height in mm	1900 (minimum)
d	Location of partition	N/A
e	Positioning door aperture centre line	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
f	Distance between tractor and trailer entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
g	No of Gates	1
14.4.3	Trailer: entry exit gates with doors; Refer C - figure 4-ahead of rear axle (near side/non-driver side)	Option three door & steps optional - purchaser/operator to decide option one or two or three
a	Door aperture mm	1200 mm
b	Clear door width (fully opened) in mm	1000 ± 50 (minimum)
c	Door height in mm	1900 (min)
d	Location of partition	N/A

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
e	Positioning door aperture centre line	Centre Line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
f	Distance between tractor and trailer entry/exit gate	Centre Line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
g	Number of gates	1
14.5	Tractor- entry/exit doors; refer E - figure 4- for (off side/driver side)- station platform at the same level	Required
a	Door aperture (without flaps) in mm	1200
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Fixed partition between gates- full height	Optional (Purchaser to decide)
	Width of partition in mm	400 (maximum)
	Location of partition	Vertical centre line of partition max 6500 mm and min 5600 from the front edge of bus (purchaser/operator to specify preferred distance as per their BRT facility)
e	Positioning doors with respect to partition	One on each side of the partition
f	Distance between tractor and trailer entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
g	Number of gates	2
14.6	Trailer (off side /driver side)	
14.6.1	Trailer- entry exit gates with doors; refer D- figure 4 -ahead of rear axle (off side/driver side)- station platform at same level	Option one (purchaser/operator to decide on option one or two)
a	Door aperture (without flaps) in mm	800
b	Clear door width (fully opened) in mm	650 ± 50

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
c	Door height in mm	1900 (minimum)
d	Fixed partition between gates - full height	Optional (Purchaser to decide)
	Width of partition in mm	400 (maximum)
	Location of partition	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
e	Positioning doors with respect to partition.	One on each side of the partition
f	Distance between tractor and trailer entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
g	Number of gates	2
14.6.2	Trailer- entry exit gates with doors; refer D- figure 4 -ahead of rear axle (off Side/driver side)- station platform at same level	Option two (purchaser/operator to decide on option one or two)
a	Door aperture in mm	1500
b	Clear door width (fully opened) in mm	1300 ± 50 maximum
c	Door height in mm	1900 (minimum)
d	Location of partition	N/A
e	Positioning door aperture centre line	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
f	Distance between tractor and trailer entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer- 6500 mm
g	Number of gates	1
14.7	Applicable for bi-articulated	
14.8	Applicable for bi-articulated	
14.9	Applicable for bi-articulated	
14.9.1	Applicable for bi-articulated	

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
14.9.2	Applicable for bi-articulated	
14.10	Applicable for bi-articulated	
14.11	Applicable for bi-articulated	
14.12	Applicable for bi-articulated	
14.12.1	Applicable for bi-articulated	
14.12.2	Applicable for bi-articulated	
14.13	Maximum first step height (mm) from ground-unladen & un-kneeled position in buses with:	
a	Stepped type entry (maximum)	400
b	Level entry (at station platform height)	No steps required
14.14	Maximum height (mm) of other steps; if required	250
14.15	Ramp for wheel chair at the gates	Suitable design mechanism for 900 mm floor ht considering that floor level of bus stops are at 400mm
a	Dimensions in mm	Minimum width 900
b	Material	Aluminium alloy with anti-slip coating
c	Load carrying capacity	> 300 kg
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200 mm	√
e	Device to lock wrapped up ramp	√
f	Kneel ramp control:	Kneeling arrangement for kneeling on left side severally and combined. Kneeling up to 60mm
g	Requirement for passenger with limited mobility	√
i	Wheel chair anchoring- minimum for one wheel chair	√
ii	Priority seats	Minimum 4 seats

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
iii	Stop request	√
h	Emergency doors/exits or apertures (Numbers)	As per AIS 052
	Dimensions in mm	As per AIS 052
i	Door closing requirements for bus movement	Bus could move only after door closing completed
i	Power operated service door- construction & control system of door to be such that a Passenger is unlikely to be injured/trapped between the doors while closing	As per AIS 052
iii	Door components	As per AIS 052
iii	Door locks/locking systems/door retention items	As per AIS 052
iv	Door hinges	As per AIS 052
15	Bus body	
15.1	Design type approval	As per Annexure-3
15.2	Bus structure - materials specifications etc	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3
15.3	Insulation	
a	Roof structure	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3
b	Engine compartment	
15.4	Aluminium extruded sections for:	
a	Rub rail	Aluminium extrusion IS 733/1983 or better
b	Decorative moulding	
c	Wire cover	

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
d	Wearing strip	
e	Foot step edging	
f	Panel beading	
g	Window frame	
h	Roof grab rail brackets	
15.5	Floor type/Materials etc	
a	Not applicable for BRTS	
b	Type of floor	Uniform flat floor
c	Not applicable for BRTS	
d	Steps on floor	No steps/hump inside bus except where required for entry/exit
e	Maximum floor slope	6%
f	Floor surface material	12mm thickness Phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having density of 1.2 gm/cc conforming to IS 3513(Part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS 710-1976/latest and fire retardant as per BIS:5509-2000 (IS15061:2002)
g	Anti – skid material	3mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy
15.6	Safety glasses and fittings:	
a	Front windscreen (laminated) glass:	Single piece laminated safety glass, plain, flat/curved with curved corners with PVB film IS 2553(Part-2)-1992/latest. Standard designs for each variant of buses to be followed. (Refer Annexure 1)
	Size:	2200mm width*1500mm height (minimum)*8.5±0.5mm thickness
b	Rear windscreen: (wherever provided)	Single piece flat/curved toughened glass-plain/flat/curved at centre & curved at corners IS 2553 (Part-2)–1992/latest
	Size:	1900mm width*950mm height (minimum)*5.5±0.5mm thickness

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
c	Side windows	Flat, 2-piece design-top fixed/sliding & bottom sliding toughened glass IS 2553 (Part-2)-1992/latest.
d	Glass specifications	Toughened glass IS2553 (Part-2)-1992/latest
	Glass thickness:	4.8-5.3mm
e	Window & other glasses- material specs, thickness etc	Toughened as per IS 2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness
f	Safety glass	As per AIS 052/CMVR
g	Rear view mirrors	As per AIS 052
15.7	Seating and gangway etc	
15.7.1	Passenger seating's	As per AIS 052
a	Seat layout	2x2
b	Seat area/seat space per Passenger (width*depth) mm	400*350
c	Seat pitch- minimum (mm)	As per AIS 052
d	Bus capacity	As per AIS 052
e	Minimum backrest ht-from floor to top of seat/ headrest	As per AIS 052
	Seat base height-distance from floor to horizontal front upper surface of seat cushion mm.	As per AIS 052
	Seat back rest height (mm)	375
f	Torso angle (degrees)	Minimum 12^0
g	Seat materials	'PPLD/LDPE' moulded AIS 023 & AIS 052 for performance
h	Seat frame structure material where required	Frame structure of ERW steel tube
i	Free height over seating position (mm)	More than 900
	Seat base height	As per AIS 052

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
j	Clearance space for seated Passenger facing partition (mm)	Minimum 350
k	Seat back/Pad material/thickness	Polyurethane foam IS15061:2002 (padding is optional)
	Type	MDI Moulded IS 5509
	Upholstery	Pile Fabric/Jekard 0.7-1mm thickness
l	Area for standee passengers (sq. mm.):	As per AIS 052
m	Number of seats including one for wheel chair	Same as bus capacity above
n	Number of standees	Same as bus capacity above
o	Sitting/standing Ratio	Not required
p	Headrest	Not required
q	Seats side facing location	Not suggested except on wheel arches
r	Seat arm	Not required
s	Magazine pouch	Not required
t	Individual seat row fans	Not required
u	Reading lights	Not required
v	Seat back rest	Fixed
w	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
x	Performance & strength requirements of:	√
i	Driver seat	AIS 023
ii	Passenger seats	AIS 023
15.7.2	Gangway:	
a	Minimum interior head room (centre line of gangway) in mm	1900 including that in the rear overhang area.

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
i	At front axle:	As per AIS 052
ii	At rear axle:	As per AIS 052
iii	Other areas	As per AIS 052
b	Gangway width (mm) from gates to longitudinal space between seats (access to service doors)	(Ref Figure-1) Minimum 700 mm excluding armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge.
c	Gangway width (mm) in longitudinal space between seats	As above
d	Gangway width (mm) in longitudinal space between seats (rear of rear edge of the rear door in RE bus)	As above
e	Driver's working space	As per AIS 052
	Driver's seat	As per AIS 052
15.8	Corrosion prevention & painting	Corrosion prevention treatment/painting for structural members/components, assembled structure, panels etc,
a	Corrosion prevention treatment	As per clause 3.17 of AIS 052
	Internal surfaces of structural members	
	External surfaces of structural members	
	After drilling holes/welding	
	Inter metallic galvanic corrosion prevention	
b	Primer coating	
c	Painting:	
16	Electrical system	BIS marked, copper conductors with fire retardant as per IS/ISO: 6722:2006 as per appropriate class. Conductor cross-section varying as per circuit requirements, minimum cross-section 0.5 sq mm. Quality marking may also be as per equivalent or better European, Japanese, US standards

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
16.1	Electrical cables:	As per AIS 052
16.2	Conductor cross section	
16.3	Safety requirements of electrical	
a	Fuse	
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	
c	Location of cables away from heat sources	
d	Type approval of circuit diagram as per standards related to electric equipments/wiring	
e	Battery cut - off switch (isolator switch):	
16.4	Wind screen wiper:	Electrically operated with two wiper arms & blades, wiper motor heavy duty steel body with minimum 2-Speed operation wiping system as per CMVR/ BIS 7827 Part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011
a	Wiper motor:	Variable speed with time delay relay as per AIS11.
b	Wiper arm/blade:	As per AIS 019/AIS011
16.5	Driver cabin fan	1 number, 200 mm fan As per provision of CMVR, matching interiors
16.6	Lighting - Internal & external and illumination	As per AIS 052
16.7	Illumination requirements/performance of:	
a	Dash board tell tale lighting/control lighting	As per AIS 052
b	Cabin lighting - luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of $\geq$ 100 lux & $\leq$ 200 lux
c	Passenger area lighting -luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of $\geq$ 100 lux and $\leq$ 150 lux
17	ITS enabled bus	As specified separately under ITS specifications

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
18	Safety related items:	
18.1	Driver seat belt & anchorage duly type approved.	ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS 005 & 015
18.2	Passengers seat belt:	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
	Number:	
18.3	Driver/Passenger/wheelchair seat belt anchorage	
18.4	Fire extinguisher:	As per AIS 052
18.5	First aid box:	1 number, As per provision of CMVR
18.6	Handrails minimum length*diameter*height above floor: mm	Colour contrasting and slip resistant of aluminium tubing 32 mm dia, 3 mm thick. Rest as per AIS 052
18.7	Handholds:	Colour contrasting and slip resistant. 2 to 4 Nos. hand holds per bay. Rest as per AIS 052
18.8	Stanchions:	Vertically fitted, aluminium tubing with Colour contrasting and slip resistant. 40 mm diameter & 3.15 mm thick. Rest as per AIS 052. As an alternative to stanchions mounted on bus floor, stanchions mounted on top of seat frames (new version seats) be explored (ref figure-2).
18.9	Not applicable for BRTS	
18.10	Passenger stop request signal	High visibility bell pushes/pully chord/touch tape shall be fitted at a height of 1.2 meter on all alternate stanchions mainly for persons with disabilities. (optional)
18.11	Window guardrails:	
a	In all school buses - minimum numbers.	Not Applicable
b	In all other buses - minimum numbers.	As per AIS 052
c	In AC super deluxe buses	As per AIS 052
d	Other details:	

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
i	First guard rail at a height from window sill mm	
ii	The distance between two guard rails mm	
18.12	Entrance/Exit Guard/Step well guard:	800 mm minimum height extending ≥ 100 mm more than centre line of sitting position of the Passenger.
18.13	Emergency exit doors, warning devices etc:	As per AIS 052/CMVR
18.14	Front/rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008
18.15	Mirrors right/left side exterior/interior:	Convex as per AIS 001 & 002. Interior with double curvature
18.16	Towing device front/rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus with 30^{o} of the longitudinal axis of the bus. As per CMVR & IS 9760- Ring Type
18.17	Warning triangle	As per AIS 052/CMVR
18.18	Fog lighting	As per AIS 052/CMVR
18.19	Bumpers- front and rear	Both made of Steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system
	Impact strength for bumpers	Meet requirement of Para 6.3.1 of AIS 052
19	Miscellaneous items/requirements	
19.1	Windows	
a	Type of window	Sliding type window panes except ACX bus
b	Minimum height of window aperture (clear vision)[1]	≥ 950 mm in type I -NDX & SDX
c	Min height of upper edge of window aperture from bus floor	As per AIS 052
d	Minimum width of windows (clear vision zone)	As per AIS 052
19.2	Cabin luggage carrier	Not required
19.3	Life cycle requirements of bus	12 years or 10,00,000 km

[1] Clear vision includes partition between fixed and sliding glass subject to a maximum width of 100 mm

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
20	Air conditioning system- test procedure for type approval	
20.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature
20.2	Target results	a) 24± 4°C (up to 42°C) b) Temperature gradient of 15° (> 42°C of saloon temperature) eg. If the saloon temperature is 45^{o}, then the target temperature inside the bus is 45^{o}-15^{o}= 30^{o} c) Minimum average air velocity at air vent is 4.5 m/s
20.3	Apparatus	Lab condition and heating chamber
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum) (for more than 42°C of saloon temperature, pull down time within 40 minutes (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers. at nose level
20.5	Air curtains on entry/exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding/alighting of Passenger with min air flow of 1000±50 m^3/hr at each gate. Type of air curtains at entry exit gates their power consumption etc be accounted for while deciding engine power, etc	Required
21	Additional requirements	
21.1	Air circulations and ventilation in driver's area	An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab
		Drivers work area to be provided with blower or suitable device (200 mm diameter fan) to ensure

	Bus specifications of articulated BRTS Bus (AC /Non -AC)	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height: 900 mm
		proper ventilation. These devices may be capable of 3 – speed adjustment
21.2	Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)- test procedure as per AIS020	84 dba (to be achieved a max noise level of 81 dba from 1st April 2015 onwards)
22	Fuel efficiency requirement	While tendering, purchaser/operator may take into account the higher weightage for more fuel efficient vehicle under standard test conditions

Chapter - 09

Specifications for Bi-articulated BRT bus for guidance

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
	Bus floor height	Floor height shall be uniform inside the vehicle
1	Propulsion system	ICE. electrical, hybrid, fuel cell
2	Fuel-options	Fuel to be compatible with propulsion system & prescribed emission norms
3	Engine	
3.1	Engine HP sufficient to provide:	
a	Rated performance at GVW in a stop/start urban operations	Geared maximum speed without speed limiter to be 75 kmph
b	Acceleration (meter/sec^2)	≥ 0.8
c	Attain bus speed of 0-30 kmph in seconds	≤ 10.5
d	Maximum speed	Geared maximum speed without speed limiter to be 75 kmph
e	Grade ability from stop at GVW	17%
f	Rated HP/torque preferably at lower rpm range	Maximum engine torque required at lower range of RPM and spread over a wider range of RPM
3.2	Emission norms	BS III/BS IV or latest as applicable
3.3	Engine management	Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed, diagnostic details message (engine specific)
3.4	Engine operational requirements	Engine should be able to operate efficiently at ambient temperatures of approximately 0^0C to 50^0C, humidity level from 5% to 100%, and altitude levels of up to 2000 meters, generally operating in the semi arid zone/hilly region prevailing in the area
3.5	Engine location	Front in tractor/rear of the second trailer module of bi-articulated bus
3.6	Transmission	Purchasers to select any one transmission system.
a	Automatic with torque convertor. Neutral during stops	
b	Automated manual	

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
4	Operational safety	Transmission system to be fitted with a mechanism which makes it possible to engage reverse gear only when vehicle is stationary (applicable for automatic & automatic manual transmission)
5	Clutch (where applicable)	Dry, single plate, power assisted operation
5.1	Applicable for articulated	
5.2	Applicable for articulated	
5.3	Applicable for articulated	
5.4.1	Rear axles of front engine Bi-articulated bus in:	
a	Rear axle of tractor – the drive axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations
b	Trailer 1 (non drive axle)	Heavy duty rigid axle
c	Trailer 2 (non drive axle)	Heavy duty rigid axle
5.4.2	Rear axles of rear engine Bi-articulated bus in:	
a	Trailer 1 - non drive axle	Heavy duty rigid axle
b	Trailer 2 - the drive axle - rear axle	Single reduction, hypoid gears, full floating axle shafts with optimal gear ratios suitable for urban operations
c	Tractor - non drive rear axle	Heavy duty rigid axle
6	Steering system	Hydraulic power steering with height and angle adjustment
7	Suspension system	Fully Pneumatic complete with ECAS/Electronic management and control systems
7.1	Front	Air bellows-2 numbers.
7.2	Applicable for articulated	
7.3	Rear axle of tractor	Air bellows-4 numbers
7.4	Trailer 1	Air bellows-4 numbers
7.5	Trailer 2	Air bellows-4 numbers

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
7.6	Kneeling (mm)	Minimum 60 mm entry/exit side severally & collectively in mixed traffic on direct routes	
7.7	Anti roll bars/stabilizers[1]	Rear axle of tractor, trailer 1 and trailer 2; and Front axle	
7.8	Shock absorbers	Hydraulic double acting at all axles	
7.9	Electronic controls of suspension system for:	Electronically controlled air suspension or superior system	
a	Controlling floor level	√	√
	Levelling control for manoeuvring	≤ 80mm	≤ 80mm
b	Enhancing comfort by absorbing shocks in case of road irregularities	√	√
c	Uniform spring rate in all loading conditions	√	√
d	Self correction of bellow height to:	√	√
i	Help protect driveline angularity related problems		
ii	Counter road unevenness		
iii	Monitor bellow failures		
iv	Provide passenger comfort		
8	Braking System	Dual circuit full air brakes, with preferably disc type arrangement for front and drum at rear brakes. Graduated hand controlled, spring actuated parking brakes acting on rear wheels (any bus delivered after 1st April, 2015 will mandatorily have disc brake in front)	
8.1	Anti skid anti brake locking system (ABS)	As per CMVR	
8.2	Electronic controls	Required	

[1] Optional in case of independent suspension

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance		
S. No.	Description	Specifications	
	Bus characteristics	Maximum floor height:900 mm	
8.3	Electronic monitoring of brakes: continuous monitoring of	√	√
a	Brake pad condition	√	√
b	Brake pad temperature condition	√	√
c	Door- brake inter locking	√	√
9	Electrical system	24 volt DC	
9.1	Batteries	Low maintenance type lead acid batteries for 24 V system- performances as per BIS 14257-1995 (latest). 2*12V of commensurate capacity. Maintenance free batteries preferred.	
9.2	Self starter	24V	
9.3	Alternator	24V (another alternator of similar capacity for AC buses)	
9.4	Electrical wiring & controls- type	As specified separately under ITS specifications	
10	Speed limiting device (optional)	Electronic type duly approved/certified as per AIS – 018/2001 or latest, tamper proof and be adjusted to applicable speed limit	
11	Tyres	Steel radial tube-less. Size and performance as per CMVR	
12	Fuel tank	Capable to enable bus operation ≥ 300 km between consecutive fillings	
	Fuel tank location	Optional	
13	Bus characteristics		
13.1	Bus dimensions mm		
a	Overall length (over body excluding bumper)	25000 (-500 mm tolerance)	
b	Overall width (sole bar/floor level- extreme points)	2600 (maximum)	
c	Overall height (unladen)-(At extreme point)	3800 (maximum)	
d	Wheel-base		

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
i	Tractor - between centre line of front axle to centre line of its rear axle	5900 (-100 mm tolerance)
ii	Trailer 1: centre line of rear axle of tractor to centre line of axle of trailer 1	5900 (-100 mm tolerance)
iii	Trailer 2: centre line of axle of trailer 1 to centre line of axle of trailer 2	7600 (-100+200 mm as tolerance)
e	Front overhang	As per CMVR
f	Rear overhang of trailer 2	As per CMVR
13.2	Maximum turning circle radius (mm)	As per CMVR
13.3	Floor height above ground (mm)	Maximum 900 with tolerance ± 20
13.4	Clearances (mm)	
a	Axle clearance (mm)	Minimum 190 mm
b	Wheel area clearance (mm)	> 220 mm for parts fixed to bus body & > 170 mm for the parts moving vertically with axle
c	Minimum ground clearance (un-kneeled) at GVW	Within the wheelbase not less than 240mm
13.5	Angles (degrees)	
a	Angle of approach (unladen)	Not less than 8.5^0
b	Angle of departure (unladen)	Not less than 9.0^0
c	Ramp over angle (half of break-over angle)	Not less than 4.8^0
13.6	Bus articulation system– for puller/pusher type bi-articulated bus	
a	Bus articulation system - general requirements	Heavy-duty articulation system
		Suitable for vehicles with higher axle loads
		Simple and clearly defined connection surfaces

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		Problem-free fitting to front and rear vehicle segments
		Nearly maintenance free
		Robust with low sensitivity to dirt and soiling
		Easy accessibility to sub systems for maintenance/replacement
		Fitted with an electronic control system that detects the driving situation
		Suitable Mechanism for anti-jack- knife joint required
		Controls driving performance and also conducts a system diagnosis for early detection of any defects.
		Interconnecting unit design to prevent separation of tractor & trailer units even in an accident with another vehicle required
		Fitting with an electronic control system that detect the driving situation, identify faults and warns for a corrective action
b	Turn table	Robust design, suitable for puller/pusher type articulated bus; Suitable mechanism to minimize honing of floor edges/prevent tripping hazard
c	Horizontal articulation along longitudinal axis	$\pm 50^0$ with 2^0 tolerance
d	Vertical articulation along transverse axis	$\pm 10^0$ with 1^0 tolerance
e	Dampers	An integrated sensor mechanism enabling continuous monitoring of the defined damper values.
		The system to ensure a minimum damping, even on failure of the electronic components.
		2- stage damping system may be considered as an optional system
f	Bellows	The bellows completely enclosing the gangway is closed under the articulation.
		Material for the folding bellows- synthetic rubber coated

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		polyester material made up of three layers of synthetic rubber and two layers of polyester mats. The material sewn together and the outside seams crimped with an aluminium reinforcement profile to give the bellows structural stiffness.
		An aluminium J shaped extrusion bent to follow the contour of the bus body with a gap under the articulated joint may be riveted to the bus body end. The folding bellow collar may be fixed into this J section with a seal and the bellows be held to the bus body by tensioning the cable.
		A typical bus bellows installation would have two bellows that are connected to a centre hoop located in the centre of the articulation. This centre hoop manufactured from an aluminium extrusion forms to provide seating for the collar of the bellows and its seal. This hoop may be steered by a pantograph steering system that position the centre hoop so that it halves both the horizontal articulation angle (52°maximum) and the vertical articulation angle(11° maximum.)
14	Bus Gates/ Doors	
14.1	Type of doors	Double jack knife on near side (non- driver side) and on off side (driver side)
a	Operating mechanism	Electro pneumatically controlled
b	Opening closing time in seconds per operation (maximum)	4
c	Positions of door controls	On dashboard, as also inside & outside of doors
d	Passenger safety system- allowing bus motion on doors closing	Mandatory

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
14.2	Front service doors; refer A - figure 5- (near side/non-driver side)- no station platform; steps required at door	Required
a	Door aperture (without flaps) in mm	800 (minimum)
b	Clear door width (fully opened) in mm	650 ± 50
c	Door height in mm	1900 (minimum)
d	Positioning front service gate	Ahead of front axle
e	Number of gates	1
14.3	Applicable for articulated	
14.4	Applicable for articulated	
14.4.1	Applicable for articulated	
14.4.2	Applicable for articulated	
14.4.3	Applicable for articulated	
14.5	Applicable for articulated	
14.6	Applicable for articulated	
14.6.1	Applicable for articulated	
14.6.2	Applicable for articulated	
14.7	Tractor entry/exit gate; refer B- figure 5 -(near side doors/non-driver side) location	Door & steps optional- purchaser/operator to decide
a	Door aperture (without flaps) in mm	1200 mm
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Fixed partition between gates - full height	Optional (Purchaser to decide)
e	Width of partition in mm	400 (maximum)

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
f	Location of partition	Vertical centre line of partition max 6500 mm and min 5600 from the front edge of bus (purchaser/operator to specify preferred distance as per their BRT facility)
g	Positioning doors with respect to partition	One on each side of the partition
h	Distance between tractor and trailer 1 entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer 1- 6500 mm
i	Number of gates	2
14.8	Trailer 1 entry exit gate with doors; refer C- figure 5 -ahead of trailer 1 rear axle (near side/non-driver side):	Door & steps optional - purchaser/operator to decide
a	Door aperture (without flaps) in mm	1200
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Number of gates	1
e	Distance between trailer 1 and trailer 2 entry/exit gate	Centre line of door aperture of trailer 1 to centre line of partition or door aperture (when no partition) of trailer 2- 6500 mm
14.9	Trailer 2 (near side/non driver side)	
14.9.1	Trailer 2 entry exit gate with doors ; refer D- figure 5 ahead of trailer 2 rear axle (near side/non-driver side)	Option one door & steps optional - purchaser/operator to decide option one or two
a	Door aperture (without flaps) in mm	800
b	Clear door width (fully opened) in mm	650 ± 50
c	Door height in mm	1900 (minimum)
d	Fixed Partition between gates- full height	Optional (Purchaser to decide)
e	Width of partition in mm	400 (maximum)
f	Location of partition	Centre line of door aperture of trailer 1 to centre line of partition

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		or door aperture (when no partition) of trailer 2- 6500 mm
g	Positioning doors with respect to partition.	One on each side of the partition
h	Distance between trailer 1 and trailer 2 entry/exit gate	Centre line of door aperture of trailer 1 to centre line of partition or door aperture (when no partition) of trailer 2- 6500 mm
i	Number of gates	2
14.9.2	Trailer 2 entry exit gate with doors; refer D- figure 5 ahead of trailer 2 rear axle (near side/non-driver side)	Option two door & steps optional- purchaser/operator to decide option one or two
a	Door aperture in mm	1500
b	Clear door width (fully opened) in mm	1300 ± 50 (maximum)
c	Door height in mm	1900 (minimum)
d	Location of partition	N/A
e	Positioning door aperture centre line	Centre Line of door aperture of trailer 1 to Centre Line of door aperture of trailer 2- 6500 mm
f	Distance between tractor and trailer entry/exit gate	Centre Line of door aperture of trailer 1 to Centre Line of door aperture of trailer 2- 6500 mm
g	Number of gates	1
14.10	Tractor- front near side doors; refer G -figure 5 - (off side/driver side) location	Required
a	Door aperture (without flaps) in mm	1200
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Fixed partition between gates- full height	Optional (Purchaser to decide)
e	Width of partition in mm	400 (maximum)
f	Location of partition	Vertical centre line of partition max 6500 mm and min 5600 from the front edge of bus (purchaser/operator to specify preferred

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		distance as per their BRT facility)
g	Positioning doors with respect to partition	One on each side of the partition
h	Distance between tractor and trailer 1 entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer 1- 6500 mm
i	Number of gates	2
14.11	Trailer 1- entry exit gate with doors; refer F- figure 5- ahead of trailer 1 rear axle; (off Side/driver side)- station platform at same level	Required
a	Door aperture (without flaps) in mm	1200
b	Clear door width (fully opened) in mm	1000 ± 50
c	Door height in mm	1900 (minimum)
d	Number of gates	1
e	Distance between trailer 1 and trailer 2 entry/exit gate	Centre line of partition of tractor or door aperture (when no partition) to centre line of door aperture of trailer 1- 6500 mm
14.12	Trailer 2 (off side/driver side)	
14.12.1	Trailer 2 entry/exit gate with doors; refer E- figure 5 ahead of trailer 2 rear axle (off side/driver side)	Option one door & steps optional - purchaser/operator to decide
a	Door aperture (without flaps) in mm	800
b	Clear door width (fully opened) in mm	650 ± 50
c	Door height in mm	1900 mm (minimum)
d	Fixed Partition between gates- full height	Optional (Purchaser to decide)
e	Width of partition in mm	400 (maximum)
f	Location of partition	Centre line of door aperture of trailer 1 to centre line of partition or door aperture (when no partition) of trailer 2- 6500 mm

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
g	Positioning doors with respect to partition.	One on each side of the partition
h	Distance between Trailer 1 and Trailer 2 Entry/Exit Gate	Centre line of door aperture of trailer 1 to centre line of partition or door aperture (when no partition) of trailer 2- 6500 mm
i	Number of Gates	2
14.12.2	Trailer 2 entry/exit gate with doors; refer E- figure 5 ahead of trailer 2 rear axle (off side/driver side)	Option two door & steps optional - purchaser/operator to decide
a	Door aperture in mm	1500
b	Clear door width (fully opened) in mm	1300 ± 50 (maximum)
c	Door height in mm	1900 (minimum)
d	Location of partition	N/A
e	Positioning door aperture centre line	Centre Line of door aperture of trailer 1 to Centre Line of door aperture of trailer 2- 6500 mm
f	Distance between tractor and trailer entry/exit gate	Centre Line of door aperture of trailer 1 to Centre Line of door aperture of trailer 2- 6500 mm
g	Number of gates	1
14.13	Maximum first step height (mm) from ground- unladen & un-kneeled position in buses with:	
a	Stepped type entry (maximum)	400
b	Level entry (at station platform height)	No steps required
14.14	Maximum height (mm) of other steps; if required	250
14.15	Ramp for wheel chair at the gates	Suitable design mechanism considering that floor level of bus stops are at 400mm
a	Dimensions	Minimum width is 900 mm
b	Material	Aluminium alloy with anti-slip coating

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
c	Load carrying capacity	> 300 kg
d	Device to prevent the wheel chair roll off the sides when the length exceeds 1200 mm	√
e	Device to lock wrapped up ramp	√
f	Kneel ramp control	Kneeling arrangement for Kneeling on left side severally and combined. Kneeling up to 60mm
g	Requirement for passenger with limited mobility	√
i	Wheel chair anchoring- minimum for one wheel chair	√
ii	Priority seats	Minimum 4 seats
iii	Stop request	√
h	Emergency doors/exits or apertures (Numbers)	As per AIS 052
	Dimensions (mm)	As per AIS 052
i	Passenger safety system - allowing bus motion on doors closing and doors opening only when the bus is stopped	Mandatory
i	Power operated service door- construction & control system of door to be such that a Passenger is unlikely to be injured/trapped between the doors while closing	As per AIS 052
ii	Door components	As per AIS 052
iii	Door locks/locking systems/door retention items	As per AIS 052
iv	Door hinges	As per AIS 052
15	Bus body	
15.1	Design type approval	As per Annexure-3
15.2	Bus structure- materials specifications etc	Material to be decided by the manufacturer OR as per the tender

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3
15.3	Insulation	
a	Roof structure	Material to be decided by the manufacturer OR as per the tender specifications issues by purchaser. Other requirements as per bus body code. Material should fulfil strength etc. requirements indicated under Annexure-3
b	Engine compartment	
15.4	Aluminium extruded sections for:	
a	Rub rail	Aluminium extrusion IS 733/1983 or better
b	Decorative moulding	
c	Wire cover	
d	Wearing Strip	
e	Foot step edging	
f	Panel beading	
g	Window frame	
h	Roof grab rail brackets	
15.5	Floor type/Materials etc	
a	Type of floor	N/A
b	Type of floor	Uniform flat floor
c	Steps on floor	N/A
d	Steps on floor	No steps/hump inside bus except where required for entry/exit
e	Maximum floor slope	6% (As per AIS 052)
f	Floor surface material	12 mm thickness phenolic resin bonded densified laminated compressed wooden floor board (both side plain surface) having

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		density of 1.2 gm/cc conforming to IS 3513(part-3): type VI 1989 or latest. The flooring should also be boiling water resistant as for marine board BIS 710-1976/latest and fire retardant as per BIS 5509-2000 (IS 15061:2002)
g	Anti– skid material	3 mm thick anti-skid type silicon grains ISO 877/76 for colour, IS5509 for fire retardancy
15.6	Safety glasses and fittings:	
a	Front windscreen (laminated) glass	Single piece laminated safety glass, plain, flat, curved with curved corners with PVB film IS 2553 (Part-2)-1992/latest. Standard designs for each variant of buses to be followed. (Refer Annexure 1)
	Size	2200mm width*1500mm height (minimum)*8.5±0.5mm thickness
b	Rear windscreen: (wherever provided)	Single piece flat/curved toughened glass-plain/flat/curved at centre & curved at corners IS 2553 (part-2)–1992/latest
	Size	1900mm width*950mm height (minimum)*5.5±0.5mm thickness
c	Side windows	Flat, 2-piece design-top fixed/sliding & bottom sliding toughened glass IS 2553 (Part-2)-1992/latest
d	Glass specifications	Toughened glass IS 2553 (Part-2)-1992/ latest
	Glass thickness	4.8-5.3 mm
e	Window & other glasses- material specifications, thickness etc	Toughened as per IS 2553 (Part-2)–1992/latest of 4.8-5.3 mm thickness
f	Safety glass	As per AIS 052/CMVR
g	Rear view mirrors	As per AIS 052
15.7	Seating and gangway etc	
15.7.1	Passenger seating’s	As per AIS 052

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
a	Seat layout	2x2
b	Seat area/seat space per Passenger (width*depth) mm	400*350
c	Seat pitch- minimum in mm	As per AIS 052
d	Bus capacity	As per AIS 052
e	Minimum back rest height-from floor to top of seat/headrest	As per AIS 052
	Seat base height-distance from floor to horizontal front upper surface of seat cushion mm.	As per AIS 052
	Seat back rest height in mm	375
f	Torso angle	Minimum 12^0
g	Seat materials	'PPLD/LDPE' moulded AIS 023 & AIS 052 for performance
h	Seat frame structure material where required	Frame structure of ERW steel tube
i	Free height over seating position in mm	More than 900
	Seat base height	As per AIS 052
j	Clearance space for seated Passenger facing partition mm	Minimum 350
k	Seat back/Pad material/thickness	Polyurethane foam IS 15061:2002 (padding is optional)
	Type	MDI moulded IS 5509
	Upholstery	Pile fabric/Jekard 0.7-1 mm thickness
l	Area for standee passengers (sq. mm)	As per AIS 052
m	Number of seats including one for wheel chair	Same as bus capacity above
n	Number of standees	Same as bus capacity above
o	Sitting/Standing ratio	Not required
p	Headrest	Not required
q	Seats side facing location	Not suggested except on wheel arches

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
r	Seat arm	Not required
s	Magazine pouch	Not required
t	Individual seat row fans	Not required
u	Reading lights	Not required
v	Seat back rest	Fixed
w	Seat belts & their anchorage	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
x	Performance & strength requirements of:	√
i	Driver seat	AIS 023
ii	Passenger seats	AIS 023
15.7.2	Gangway:	
a	Minimum interior head room (centre line of gangway) in mm	1900 including that in the rear over hang area
i	At front axle	As per AIS 052
ii	At rear axle	As per AIS 052
iii	Other areas	As per AIS 052
b	Gangway width (mm) from gates to longitudinal space between seats (access to service doors)	(Refer figure-1) minimum 700 mm excluding armrests (armrests are not required) and including stanchions- will be measured from seat edge to seat edge.
c	Gangway width (mm) in longitudinal space between seats	As above
d	Gangway width (mm) in longitudinal space between seats (rear of rear edge of the rear door in rear engine bus)	As above
e	Driver's working space	As per AIS 052

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
	Driver's seat	As per AIS 052
15.8	Corrosion prevention & painting	Corrosion prevention treatment/painting for structural members/components, assembled structure, panels etc,
a	Corrosion prevention treatment	As per clause 3.17 of AIS 052
	Internal surfaces of structural members	
	External surfaces of structural members	
	After drilling holes/welding	
	Inter metallic galvanic corrosion prevention	
b	Primer coating	
c	Painting	
16	Electrical system	BIS marked, copper conductors with fire retardant as per IS/ISO 6722:2006 as per appropriate class. Conductor cross-section varying as per circuit requirements, minimum cross-section 0.5 sq mm. Quality marking may also be as per equivalent or better European, Japanese, US standards
16.1	Electrical cables	As per AIS 052
16.2	Conductor cross section	
16.3	Safety requirements of electrical	
a	Fuse	
b	Isolation switches for electrical circuits where RMS value of voltage exceeds 100 volts	
c	Location of cables away from heat sources	
d	Type approval of circuit diagram as per standards related to electric equipments/wiring	
e	Battery cut- off switch (isolator switch)	

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
16.4	Wind screen wiper	Electrically operated with two wiper arms & blades, wiper motor heavy duty steel body with minimum 2-Speed operation Wiping system as per CMVR/BIS 7827 Part-1, 2, 3 (Sec.1 & 2)/latest. As per AIS 011
a	Wiper motor	Variable speed with time delay relay as per AIS11.
b	Wiper arm/blade	As per AIS 019/AIS011
16.5	Driver cabin fan	1 no., 200mm fan As per provision of CMVR, matching interiors
16.6	Lighting- internal & external and illumination	As per AIS 052
16.7	Illumination requirements/performance of:	
a	Dash board tell tale lighting/control lighting	as per AIS 052 & bulbs tested for Photometry as per IS 1606:1996
b	Cabin lighting- luminous flux of all lamps for cabin lighting	As per AIS 052 with illumination level of ≥ 100 lux & ≤ 200 lux
c	Passenger area lighting- luminous flux of all lamps for Passenger area lighting	As per AIS 052 with illumination level of ≥ 100 lux and ≤ 150 lux
17	ITS enabled bus	As specified separately under ITS specifications
18	Safety related items:	
18.1	Driver seat belt & anchorage duly type approved	ELR recoil type, 3 point mounting as per CMVR & AIS 052 conforming to AIS 005 & 015.
18.2	Passengers seat belt	Not necessary except diver seat & wheel chair (performance etc. as per AIS 052)
	Number	
18.3	Driver/Passenger/Wheel chair seat belt anchorage	
18.4	Fire extinguisher	As per AIS 052
18.5	First aid box	1 Number, As per provision of CMVR

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
18.6	Hand rails minimum length*diameter*height above floor (mm)	Colour contrasting and slip resistant of aluminium tubing 32 mm dia, 3 mm thick. Rest as per AIS 052
18.7	Handholds	Colour contrasting and slip resistant. 2 to 4 Numbers. Handholds per bay. Rest as per AIS 052
18.8	Stanchions	Vertically fitted, aluminium tubing with colour contrasting and slip resistant. 40 mm dia & 3.15 mm thick. Rest as per AIS 052. As an alternative to stanchions mounted on bus floor, stanchions mounted on top of seat frames (new version seats) be explored (refer figure-2).
18.9	Not applicable for BRTS	
18.10	Passenger stop request signal	High visibility bell pushes/pully chord/touch tape shall be fitted at a height of 1.2 meter on all alternate stanchions mainly for persons with disabilities. (optional)
18.11	Window guardrails:	
a	In all school buses- minimum numbers	Not applicable
b	In all other buses- minimum numbers	As per AIS 052
c	In AC super deluxe buses	As per AIS 052
d	Other details:	
i	First guard rail at a height from window sill mm	
ii	The distance between two guard rails mm	
18.12	Entrance/Exit guard/Step well guard	800 mm minimum height extending ≥ 100 mm more than centre line of sitting position of the Passenger.
18.13	Emergency exit doors, warning devices etc	As per AIS 052/CMVR
18.14	Front/rear door, step well lights, door open sign	Incandescent bulb/LED as per AIS 008
18.15	Mirrors right/left side exterior/interior	Convex as per AIS 001 & 002. Interior with double curvature
18.16	Towing device front/rear	Heavy duty 1.2 times (minimum) the kerb weight of the bus with

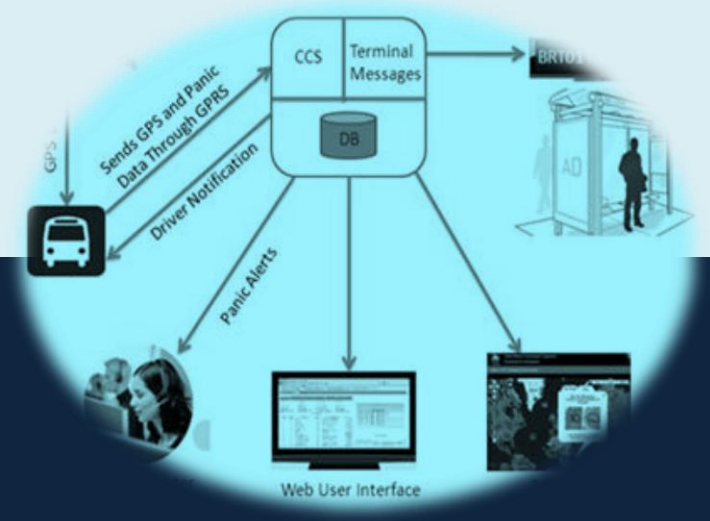
	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
		30^{o} of the longitudinal axis of the bus. As per CMVR & IS 9760 - Ring Type
18.17	Warning triangle	As per AIS 052/CMVR
18.18	Fog Lighting	As per AIS 052/CMVR
18.19	Bumpers- front and rear	Both made of steel or impact resistant polymer or combination of both meeting requirement of an energy absorbing system
	Impact strength for bumpers	Meet requirement of Para 6.3.1 of AIS 052
19	Miscellaneous items/requirements	
19.1	Windows	
a	Type of window	Sliding type window panes except ACX bus
b	Minimum height of window aperture (clear vision)[2]	≥ 950 mm in type I -NDX & SDX
c	Min height of upper edge of window aperture from bus floor	As per AIS 052
d	Minimum width of windows (clear vision zone)	As per AIS 052
19.2	Cabin luggage carrier	Not required
19.3	Life cycle requirements of bus	12 years or 10,00,000 km
20	Air conditioning system - test procedure for type approval	
20.1	Specifications	a) For up to 42°C of saloon temperature and b) For > 42°C of saloon temperature
20.2	Target results	a) 24+/- 4°C (up to 42°C) b) Temperature gradient of 15° (> 42°C of saloon temperature) e.g. If the saloon temperature is 45^{o}, then the target temperature inside the bus is 45^{o}-15^{o}= 30^{o} c) Minimum average air velocity at air vent is 4.5 m/s

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

	Bus specifications for Bi-articulated BRTS Bus (AC/Non -AC) for Guidance	
S. No.	Description	Specifications
	Bus characteristics	Maximum floor height:900 mm
20.3	Apparatus	Lab condition and heating chamber
20.4	Procedure	1. Soak for 1 hour 2. At 2000 rpm 3.Upto 42°C: pull down time 30 minutes (maximum) (for more than 42°C of saloon temperature, pull down time within 40 minutes (maximum)) 4. Thermocouple to be placed over place minimum 20 numbers. at nose level
20.5	Air curtains on entry/exit gates to avoid loss/gain of heat and or cool air when doors are frequently opened for boarding/alighting of Passenger with min air flow of 1000±50 m^3/hour at each gate. Type of air curtains at entry exit gates their power consumption etc be accounted for while deciding engine power, etc	Required
21	Additional requirements	
21.1	Air circulations and ventilation in driver's area	An air passage/duct/roof hatch to be provided in driver area at a suitable location for proper inflow of air inside the driver cab Drivers work area to be provided with blower or suitable device (200 mm diameter fan) to ensure proper ventilation. These devices may be capable of 3 – speed adjustment
21.2	Maximum noise levels inside the saloon (irrespective of AC, non-AC/fuel type/engine location)-test procedure as per AIS020	84 dba (to be achieved a max noise level of 81 dba from 1st April 2015 onwards)
22	Fuel efficiency requirement	While tendering purchaser/operator may take into account the higher weightage for more fuel efficient vehicle under standard test conditions

Chapter - 10

Specifications for Intelligent Transport System (I.T.S.)



Objectives:

1. Harness currently available technologies, with convergence and relevance for the period of the 'Plan' and beyond.
2. Provide a clear and perceptible upgrade over 2008 specifications incorporating the various feed back of the past implementation.
3. Enhance commuter experience and quality/ substance of visual displays
4. Make vehicle more driver friendly
5. Enhance vehicle and customer safety
6. Improve operating efficiency by reducing variable costs such as fuel, brakes and human resource
7. Increased usability ,reliability and life with value for money
8. Standardize, with minimum subjectivity, requirements and responsibilities of various stake holders namely OEMs, purchasers/operators, equipment suppliers, certifying agencies like ARAI and CIRT
9. Empower purchasers/operators with adequate information and details for tendering
10. Serve as a guideline for purchaser/operator to design ITS based infrastructure at respective control centres and/or depots for enhancing operating efficiencies
11. Define inputs from the bus for 'bus shelter sign' applications (via control centre)
12. Serve as a guideline for 'agencies' like BIS, ARAI, CIRT and ASRTU

9.0 Electrical system

9.4 Electrical wiring & controls – type

9.4.1 Usability/Functionality/Capability

a Control power supply to and monitor status (voltage, current, faults) of all external and internal fixtures like passenger/driver compartment illumination, fans, buzzer, horn and ITS equipments. Power to ITS equipments will be available even when the engine is not running. This will be provided by putting the "Ignition- ON" Switch followed by switch for ITS equipments

b It should have an inbuilt fault identification, diagnostic and recovery system for the above

c Receive data from various sensors to assist monitoring vehicle safety/performance features such as

i Fuel /oil - level/ pressure

ii Braking pedal position

iii Accelerator pedal position and kick down

iv Brake pad condition and brake pedal temperature (in case of electronically controlled disc brakes)

v Door interlock

vi Kneeling interlock (wherever provided)

vii Gas leakage detection (wherever provided)

viii Fire detection/suppression (wherever provided)

d Diagnostic data from engine and transmission will be provided to VHMD, a minimum list of parameters mentioned is given as per Annex 1 -clause 3,4,5 & 6

9.4.2 Architecture-multi 'Node'

a Each node with its own microprocessor (16 bit minimum)

b Memory (flash minimum 256kb, RAM minimum 64kb, EEPROM minimum128kb)

c Internal communication on CAN 2B

d 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 side

iv Digital low side

e Inputs

(1) Analog

(2) Digital high/low side

(3) for frequency/pulse counting

(4) For signal amplification

f Each node to be IP54 certified and to comply with test standards under Annex 2

9.4.3 Primary source of data input to 'SCU' for 'VHMD' via CAN 2B(J1939)

a As required under clause 17.5 and Annex1.

b All 'CAN' parameters will be input to SCU in standard format "standardized message name, PGN, SPN and rate

17.0 ITS enabled bus - On Bus Intelligent Transport System –OBITS

17.1 Architecture

a The architecture defines the overall inter connectivity of the different sub system inside the vehicle, communication within the sub systems and connectivity to the backend solution for the transmission of the real time vehicle information. It shall consists of following sub systems

i Passenger information system (PIS)

ii Automatic vehicle location system (AVL)

iii Security camera network system (SCN)

iv Vehicle health monitoring and diagnostics (VHMD)

v On-board pole mounted ticketing machines

b The single control unit 'SCU', together with single bus driver console 'BDC', form the nucleus of the on- bus vehicle intelligent transport system (OBITS)

17.2 PIS System

17.2.1 Usability/Functionality/Capability

a All drivers related interfaces (input/output/feedback) for PIS must be provided on SCU & BDC

- **i** The route programming file to be uploaded on SCU
- **ii** Route selection function is to be provided on BDC
- **iii** All driver related route information to be displayed on BDC

b Amber colored, alphanumeric with graphic capability

c In-built light sensor with continuously variable brightness control to enable the display intensity to change based on ambient light conditions

d Viewing distance

- **i** Front, side and rear signs 50 meters minimum, for single line text, in day and night.
- **ii** Inner 15 meters minimum, for single line text in day and night.

e Display Characteristics

- **i** Fixed, scrolling and flashing mode (with fixed route number, upto 6 characters, on front, side and rear signs).
- **ii** Capability to show customized graphics.
- **iii** Two lines English /one line local language.
- **iv** Total display height should accommodate two lines in English language and the Individual heights of each line should be adjustable to enable one line to be larger/smaller than the second line. However during next stop announcement only single line text is required
- **v** It should be possible to display, concurrently, different messages on each of the signs (front, rear, side and inner).

vi It should be able to display special signs like signs for 'PWD enable bus', ‘ladies special’.

f Signs should have ability to retain the last message displayed in the memory of the sign even in the event of power failure and without the message being reloaded from SCU. Test will be performed by disconnecting the SCU from the sign and power to the sign will be switched ‘off’ and ‘on’ to see if the Last message is retained and displayed.

g Display and voice announcement in English and local languages using Microsoft fonts (or any other as specified in tender) via window based software package (window 7 or latest at the time of inviting the tenders).

h The system should have a programming capability as under

i Minimum 75 routes UP and DOWN (150 numbers of destinations) on front, side and rear signs.

ii GPS triggered next stop display on Inner sign with synchronized voice announcement for minimum 75 stops on each route.

iii The inner sign should be able to display and announce upto three languages, one after the other in sequence. For example make display and announcement in English, then Hindi to be followed by local language for benefit of the passengers. Display and announcements should be possible "before arrival" of the bus at the bus stop, "on arrival" of the bus at bus stop and "after departure" of the bus from the bus stop.

iv In event of GPS failure the above functionality should be possible through manual intervention on BDC.

v Display driver and conductor ID once in between the stops on Inner sign

vi Inner sign should be able to display text and customized graphics and announce upto pre-recorded messages by driver selecting 1~9 on BDC display panel of the controller.

vii Display customized graphics plus synchronized voice announcement – location based

viii Functionality of Display 'clock'-GPS based or ‘Default Messages’ on Inner sign

ix Emergency 'stop' request function- by pressing an emergency switch placed anywhere in the bus the inner sign should display 'stop' message and buzzer located near the driver makes the sound alerting the driver to stop the bus.

i Two way communication with central control centre(CCC) via SCU

- It should be possible to change/choose/select a 'route' remotely over the air from back office and provide current route information to back office
- It should be possible to transmit adhoc messages (English) from back office to internal sign.
- Back office should be able to check, via SCU, the version of firmware loaded on the signs.

j Sign should be able to store 'diagnostic trouble codes' (DTC)','parameters identifiers (PID) as per Annex 3 and data should be retrievable through SCU.

k To comply with test standards under Annex 2

17.2.2 Dimensions and technical specifications of destination signs

a Display size

i Front minimum 200x1800 mm –one

ii Rear and side: minimum 200x900 mm-one each

iii Inner : minimum100x800 mm –one

iv For Articulated buses 1 front, 2 inner, 2 side sign and one rear will be employed.

v For mini and midi buses one sign in front of size minimum 200X900 mm and one inner sign minimum100x800 mm

b Pitch

i Front- maximum. H 13.4 mm x V14.1 mm (maximum H10.5 mm x V 14.1mm for mini/midi buses)

ii Side and rear maximum. H10.5 mm x V 14.1mm

iii Inner 8 x 8 mm maximum.

c LED and display quality front, side and rear signs

i Amber colored LED, dominant wave length 591~595nm (color matched and bin graded).

ii UV resistant, diffused lens 4 mm (minimum) or 'SMT PLCC2 standard package'

iii Wide viewing angle 120° horizontal & 60° Vertical

iv Ensure enhanced readability with full clarity on scrolls and long life usage by incorporating non multiplexed system (constant current drive circuit) with typical LED Intensity 400~700 mCd at If =20 mA, alternatively multiplexed design (maximum 4:1) with typical LED intensity 950~1150 mCd at 20 ma

d LED and display quality inner sign

i LED amber dot matrix viewing angle 45° all around, intensity minimum 40 mCd, dominant wave length 590 ~595 nm

e Structure

i Front ,side and rear signs : light weight structure with toughened glass fixed with UV resistant adhesive in front

ii Inner sign: light weight structure with poly glass /acrylic/toughened glass.

iii Electronic devices used to be 'automotive grade' rated for temperature -25°C to +85°C (so as to meet tests specified in Annx 2) with conformal coated PCB boards

iv Power to signs shall be supplied through bus multiplex wiring system

17.3 Automatic vehicle location (AVL) system

17.3.1 SCU will transmit raw GPS data ,of vehicle locations, in NMEA protocol , to back office control centre at user configurable frequency (5 seconds or less),via 3G(GSM)/GPRS, for further processing and use ,including that for signs on bus stops ,BRTS and bus terminals.

17.4 Security camera network (SCN) system

17.4.1 Usability/Functionality/Capability

a The Network surveillance system shall consist of

i High resolution cameras, two numbers to monitor bus interiors (doors, driver zone, ticketing zone etc.) and one reversing surveillance camera. For midi/mini buses 1 ambient and 1reversing and for articulated buses 3 ambient and 1 reversing camera to be employed.

ii Capability of 48 hour recording of images in 'CIF' mode (no sound) for total of four cameras. The recording will be overwritten if not down loaded after the memory is fully utilized.

iii Capability to transfer the recordings to control centre/depot through SCU via high speed WLAN network (with back haul), in compressed format

iv Capability to transfer the recordings using SD-card (if provided-refer 17.4.2 a below), tagged to vehicle ID, which is physically removed and transferred to a card reader attached to the depot server.SD card will be provided in a lockable compartment.

v Capability to transfer recording using USB

b Recording functionalities

i Continuous or schedule based recording

ii Event based recording triggered by SCU (VHMD).

iii Event based recording triggered by sensors connected to the 'recorder'(if provided separately)

iv Disconnected camera detection

v Auto shut down delay after ignition switch off

vi Auto reset after power break

vii Built in clock

viii Emergency operation: when activated by a foot operated micro pedal switch, the recording will take place at a preselected resolution and FPS.

c SCU should be able to display on BDC one or more cameras at the same time upto maximum 4.

d BDC to display only reversing camera picture when reverse gear is engaged.

17.4.2 Architecture

a 'Recording functionality' could be provided in a 'separate box (recorder)' or alternatively could be in-built into SCU in which case hard disc will be used instead of SD card for storage. The choice will be of the equipment supplier

b Power supply to 'recorder' will be provided through the bus multiplexing system.

c Power supply (12V regulated) to camera will be provided from

i 'Recorder'.

ii Through the bus multiplexing system when 'recording functionality' is provided in SCU

17.4.3 Specifications

a 'Camera' specifications

i Fixed lens 3.6 mm

ii Picture resolution upto 752 H x 582 V (PAL),

iii Resolution = 420 TV lines minimum,

iv Picture sensor =1/3" CCD or better,

v IR distance 10 meters minimum ,

vi Automatic backlight compensation

vii Ingress protection rating IP66 minimum

b 'Recorder' specifications

i 4 Channel minimum

ii Recording resolution PAL

(1) CIF (352X288) upto 25 fps maximum each of 4 channel

(2) D1 (704X576) upto 25 fps maximum -one channels only

(3) DI (704X576) upto 12 fps maximum each of 4 channels,

iii Stream standards: ISO 1449, video compression standard H.264.

iv 48 hour (for total 4 channels) recording of images and voice in CIF mode.

17.4.4 Alternate system

IP (internet protocol) digital camera using ‘network recording' is also permitted with equal or better specifications.

17.5 Vehicle health monitoring and diagnostics (VHMD)

17.5.1 ‘SCU’ will receive vehicle health diagnostic data from multiplexing nodes and PIS signs

a The data from multiplexing nodes, on a single CAN 2B(JI939) bus will include parameters from

i Vehicle electrical system powered through multiplexing nodes

ii Vehicle safety and performance features

iii Engine and transmission

The list of such parameters is as per Annex 1. All ‘CAN’ parameters will be receivable in standard format "standardized message name, PGN, SPN and rate.

b The data from PIS signs will include parameters specified in Annex 3

17.5.2 ‘SCU’ should be able to create log files and communicate to control centre at end of the day via WLAN the data related to parameters in Annex 1.The log files will be overwritten if not down loaded.

17.5.3 SCU should be able to communicate to control centre, in case any of the parameters listed in Annex 1, exceed a predefined value at any time .Such warning will also pop up real time on BDC screen. The number of such prompts will be five (maximum) at any time.

17.5.4 SCU should be able to display following parameters on BDC for viewing by driver/workshop technician.

a Engine oil pressure, engine coolant temperature, engine speed in RPM, vehicle speed.

b Transmission output shaft speed, transmission input shaft speed, transmission current gear, transmission oil filter restriction switch, transmission oil life remaining, transmission service indicator, transmission sump oil temperature, transmission oil level high / low, hydraulic retarder oil temperature

c 'Nodes' output status-parameters to be pre agreed at the time of tender.

d Vehicle performance/safety features such as brake condition ,door Interlock ,Kneeling interlock (wherever specified), gas leakage detection (wherever specified), fire detection and suppression (wherever specified).The responsibility of providing requisite sensors for such parameters rests with the OEM.

e Any other engine, transmission diagnostic data –parameters to be pre agreed at the time of tender.

17.5.5 SCU should be able to communicate to control centre, in real time, a pre selected 5 parameters (out of those mentioned above in 17.5.4).

17.6 On board hand held ticketing machine with smart card

17.6.1 Specifications

a As per MOUD letter k/14011/28/2009-metro (PT) dated 9th may 2012.

b No compatibility required with SCU and OBITS

17.7 On board pole mounted smart card ticketing terminals

17.7.1 Specifications

a Two numbers, one each at two gates system. Specifications as per as per MOUD letter k/14011/28/2009-metro (PT) dated 9th may 2012.

17.7.2 Architecture

a SCU should be able to provide route, GPS information in XML format over TCP socket to ticketing machine.

b Ticketing machine should be able to connect through Ethernet port to enable it send information via the gateway on SCU. All such transmission between ticketing machine and depot/CCC has to be 'secured' at the origin. Purchaser/operator shall make necessary arrangement for identifying ticketing equipment and the protocol to be interfaced.

17.8 SCU and BDC architecture

17.8.1 Usability/Functionality/Capability

a Integrate and interface all features of

- **i** Passenger information system (PIS)
- **ii** Automatic vehicle location system (AVL)
- **iii** Security camera network system (SCN)
- **iv** Vehicle health monitoring and diagnostics (VHMD)
- **v** On-board pole mounted ticketing machines

b Provide the driver/user interface/display on BDC as specified elsewhere in this document

c Display camera images on BDC as specified elsewhere in this document

d Control PIS functionality as specified elsewhere in the document

e Provide two-way voice and data link with control centre to communicate data and information as specified elsewhere in this document. The link will be based on open public communications network services 3G (GSM) with downward compatibility with 2G

f Provide wireless LAN (WiFi) interface for wireless communications between the vehicle and depot network as specified elsewhere in this document .This interface will not be available to passengers.

g Provide capability to upload firmware/ software and configuration of parameters on 'SCU' via the wireless LAN

h Provide audio interface to the driver's microphone and earpiece or speaker using wired link to SCU (Telephone dial up is not envisaged)

i BDC ,on a selectable ‘menu’ will have ‘panic’ options’ for communicating pre configured messages to control centre

j Capability to store 'diagnostic trouble coded' (DTC)' ,'parameters identifiers (PID) as per Annex 3

k To comply with test standards under Annex 2

17.8.2 Technical specifications: SCU

a Processor : 32/ 64 bit

b Operating system: embedded Windows/Linux with programming software(Windows 7 or latest at the time of calling the tenders)

c Memory : flash: 2 GB minimum, RAM 512 MB minimum (RAM memory includes SCU and BDC)

d Interface : CAN 2.0, RS 485,RS 232, fast Ethernet, USB, digital outputs, digital/Analog inputs, WLAN, audio input output,, amplified audio output

e Interface protocols :as specified elsewhere in this document

f In built GPS and 3G(GSM) modules

g WLAN

h Combi antenna using RG174 cable. The connectors on Combi antenna will be preferably SMA(M) ST plug type for GPS and FME(F) jack type 1/4"-36UNS-2B for 3G

i In built /external two channel amplifier minimum 10 Watts rms each suitable for 4 ~8 Ohm impedance with input for external microphone

j In-built MP3 files storage/playback function.

k Power to SCU & BDC will be supplied through bus multiplexing wiring system

17.8.3 Technical Specifications: BDC

a Display

i Size 5.7" diagonal minimum

ii Full color graphic TFT-640 x 480 dots minimum, capable of showing minimum 20 lines in English.

iii Viewing angle (horizontal) 60°/75° (right/left)/ (vertical) 60°/75° (up and down)

iv Adjustable back lighting

b Key board :4 keys minimum

17.8.4 Technical specifications: GPS modules

a Rating:22 tracking/66 acquisition minimum

b Tracking sensitivity :-165 dBm typ

c Navigation sensitivity ; -148 dBm typ

d Update rate I Hz (configurable to 10 Hz)

e Time to first fix cold acquisition 35 seconds typ

f Hot acquisition 1 second typ.

g Navigation accuracy 3M horizontal

17.8.5 Technical specifications: 3G(GSM) modules

a GSM/GPRS SMT quad band and UMTS (3G)

b Temperature range -40°C to +85°C

17.8.6 Technical specifications: 'Combi' Antenna

a AMPS 850MHz, GSM900MHz, ISM868MHz, DCS1800MHz, PCS1900MHz, 3G UMTS 2.1GHz, Wifi /Blue Tooth (2.4 GHz),GPS (1575.42MHz). Separate WLAN antenna may be provided if necessary.

b GPRS

- **i** Impedance 50 Ohm
- **ii** Radiation pattern Omni-directional
- **iii** Polarization linear (vertical)

c GPS

- **i** Impedance 50 Ohms
- **ii** VSWR <1.5:1
- **iii** Polarization RHCP

d Waterproof IP-66

e Temperature range -40°C to +85°C

f RG174 cable

17.8.7 Fitment on bus

a All 'OBITS' equipment including wiring harness, antennas to be original factory fitment.

b Front, side, rear signs should be mounted with a gap with the glass so that the glass on signs and of the bus can be cleaned by swiping

c All equipment should be fitted in a way to minimize unintentional damage, shielded from direct engine heat, protected from water splash and dust.

d All cables need to be properly anchored

e Others:

- **i** Front sign: central
- **ii** Rear sign: central
- **iii** Side sign: first window ahead of rear door (central line of sign should coincide with central line of window)
- **iv** Inner sign: centralize along the width of bus behind the driver's partition

v Speakers with protective grill : one each near the doors and others equally distributed across the length of the bus- Total no. 4

vi SCU, recorder, amplifier : secured and ventilated compartment right above the driver

vii BDC: ergonomically placed for driver ease

viii Camera: as specified else where

ix Ticketing machines - pole Mounted: as specified elsewhere

x Combi antenna: suitable place to define inside the bus (preferably) with direct line of view for 'affixing' the unit.

17.8.8 Communication amongst sub systems

a	'Signs' to 'SCU'	RS 485
b	'Multiplexing nodes' to 'SCU'	CAN 2B (J1939)
c	'Camera' to 'Recorder'	AVI or Ethernet (for 'IP' camera option)
d	'SCU to 'BDC'	Ethernet/DVI/VGA/HDMI/RS232/RS485 as required.

e Add -on 'Ethernet switch' and CAN ports are permitted

17.8.9 Communication between SCU and depot/central control centre (CCC)

a AVL to CCC:

Raw GPS data in NMEA 0183 protocol (GPVTG, GPGGA, GPRMC, GPGSV and GPGSA) and route number via open public communications network services 3G and download compatibility

b VHMD real time warning to CCC

Open public communications network services 3G and download compatibility

c VHMD end of the day to depot

IEEE 802.11 Wireless LAN (WiFi) via 'Back haul' at depot

d SCN 48 hour recording to depot

IEEE 802.11 Wireless LAN (WiFi) via 'Back haul' at depot plus SD card physical transfer/USB physical transfer

e **Firmware download from Depot**

IEEE 802.11 Wireless LAN (WiFi) via 'Back haul' at depot

f **PIS Two way communication to** depot need based, API to be pre-agreed

g Any protocol provided by ITS supplier will be under a 'NDA' amongst the parties

17.8.10 Additional requirements of Purchaser/Operator

a If required, Purchaser/Operator can specify as a part of their tender requirements, unambiguously, any additional requirement in relation to 'interface' with their ITS Infrastructure.

17.8.11 TA' and 'COP' approvals

a The notified agencies, as under rule number 126 of CMVR, will be responsible for approvals and certification of 'OBITS' system as defined above.

b Above approvals ,when accorded to sub system suppliers such as PIS ,SCU and BDC, etc will be valid across the board for various purchaser/operator, OEMs and tenders

17.8.12 Warranties

a The standard warranty will be identical to the warranty of bus (up to 3 years maximum) however purchaser/operator may ask OEMs for extended warranty /annual maintenance contract after expiry of standard warranty periods.

17.8.13 ITS Infrastructure at Purchaser/Operator

a Purchasers/Operator(s) are obligated to install the necessary ITS infrastructure and human resource to 'take over' the OBITS system from OEMs and have their own cell for day to day operations and needs. Typical examples being: PIS route programming including voice recordings ,maintaining up-to-date LAT LONG database, 'Back Haul' operations.

b OEMs are obligated to provide training to such purchaser/operator(s) staff before delivery of buses.

c **Driver Score Card/Driver rating:** Purchasers/Operator(s) are obligated to make use of the information from OBITS to incorporate a practice of 'Driver Score Card'. A few suggested parameters are

I. Door Open while driving
II. Harsh Acceleration
III. Excessive Idling
IV. Harsh Braking
V. Over revving
VI. Over speeding
VII. Excessive Trip Mileage (Fuel Mileage)
VIII. Non Adherence to 'Trip Schedule' e.g. 'Late Start', 'Off Route' and 'Duty Cycle'
IX. Driving with Faults: Warning Pop ups reported and initiative to get corrected
X. Panic Button usage
XI. Cameras switched off
XII. Internal Sign Switched off

Data from the above will be based on

- VHMD Log files and SCN data downloaded at end of the day including Driver ID
- Live AVL location transmitted from Bus.

Annexure 1: VHMD parameter list

All data will be provided by bus multiplexing node

1. **Vehicle electrical system**

   All external and internal fixtures like passenger/driver compartment illumination and ITS equipment.

2. **Vehicle safety and performance features**

   - Fuel /Oil level/ Pressure
   - Braking pedal position
   - Accelerator pedal position and kick down
   - Brake pad condition and brake pedal temperature (in case of electronically controlled disc brakes)
   - Door interlock
   - Kneeling interlock (wherever provided)
   - Gas leakage detection (wherever provided)
   - Fire detection/suppression (wherever provided)

3. **Engine**

   - Engine CAN status
   - Engine oil pressure,
   - Engine coolant temperature,
   - Engine speed in RPM,
   - Vehicle speed (torque),
   - Diagnostic message (engine specific)

4. Transmission

- Transmission CAN status
- Transmission output shaft speed
- Transmission input shaft speed
- Transmission current gear
- Transmission oil filter restriction switch
- Transmission oil life remaining
- Transmission service indicator
- Transmission sump oil temperature
- Transmission oil level high / low
- Hydraulic retarder oil temperature
- Accelerator pedal
- Diagnostic message (transmission specific)

5. Diesel bus electronics data (list is indicative, to be finalized by respective purchasers/operators)

- Drivers demand of engine torque percentage
- Actual engine torque percentage
- Engine and retarder torque
- Engine speed

- Source address controlling device
- Engine starter mode
- Engine demand torque percentage
- Accelerator pedal 2 low Idle switch
- Road speed limit status
- Accelerator pedal kick down switch
- Accelerator pedal low Idle Switch
- Accelerator pedal position
- Percent load at current speed
- Remote accelerator pedal position
- Accelerator pedal position 2
- Vehicle acceleration rate limit status
- Engine temperature
- Engine coolant temperature
- Fuel temperature
- Engine oil temperature
- Turbo oil temperature
- Engine intercooler temperature
- Engine intercooler thermostat opening
- Engine fluid level pressure
- Fuel delivery pressure

- Extended crankcase blow by pressure
- Engine oil level
- Engine oil pressure
- Crankcase pressure
- Coolant pressure
- Coolant level

6. CNG bus electronics data (list is indicative, to be finalized by respective purchaser/operators)

- Engine control unit
- Engine speed sensor
- Atmospheric pressure sensor
- Brake switch signal
- EEPROM error
- Vehicle speed sensor
- Main relay main relay
- Ignition switch
- Fuel temperature sensor
- Turbocharger boost pressure sensor
- Boost pressure control
- Accelerator pedal position sensor 1
- Accelerator pedal position sensor 2

- Analog/digital converter
- Coolant temperature sensor
- Fault lamp, engine control
- Electric shutoff (ELAB)
- Needle sensor
- Secondary engine speed signal
- engine speed sensor
- Start-of-injection control
- Injection timing solenoid valve
- Voltage supply control units
- Reference voltage
- air temperature sensor
- Control-collar travel sensor
- Control-collar travel sensor
- Test after running test
- Control-collar travel sensor
- Engine control unit
- Misfire recognition

Annexure 2: Test Standard Compliance Document

These tests standard compliances are common to PIS signs/multiplexing nodes/controller/driver console

Sr. No	Test standards compliance	Specifications
1	**Performance parametric test**	Nine points, tri temperature/tri voltage- 18V, 27V, 32V,-25°C, room temperature, +85°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 -25°C for 2 hours in 'on' condition
3	**Dry heat**	IS 9000 (Part III/Sec 5)-1977: PIS Signs, SCU and Nodes at + 80^0C for 16 hours in 'on' condition. BDC at + 80^0C for 2 hours
4	**Damp heat**	IS 9000 (Part V/Sec 2)1981 at +25°C /+55°C, Humidity 95%, 24 hours for 6 cycles in off condition. Functional test with power in 'on' condition at start of 2nd, 4th and 6th cycle
5	**Vibration-standard AIS 012/AIS:062 -10g**	• Frequency 5~50Hz and return to 5Hz at a linear sweep period of 1 minute/complete sweep cycle and 10g at maximum frequency • Excursion -1.6 mm peak to peak over the specified frequency range • Test duration 60 minutes Direction of vibration –X, Y, Z axis of device as it is mounted on the vehicle.
6	**Dust and water ingress protection**	IS /IEC 60947-1:2004 in conjunction with IS/IEC 60529:2001– 'PIS signs' IP66, 'SCU' IP 65, 'BDC' IP65, 'nodes' IP54
7	**Free fall**	IS 9000 (Part VII/Sec 4) Free fall at 500 mm ,(applicable to 'nodes' and 'controllers'

Sr. No	Test standards compliance	Specifications
		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 without fuse**	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**	The Insulation résistance measured as per ISO 16750-2 with a voltage of 500 V dc shall not be less than 1Mega ohm.
12	**Cranking voltage**	The components shall have an electrical energy reserve that can handle voltage drop during cranking. Component shall not reset during cranking-'FSC B'. The supply voltage during crank is 18.0 V for 40 ms. The test to be carried out as per ISO 7637
13	**Load dump test on controller**	123V ,8 Ohms 200ms pulse 5a as per standard ISO 7637-2
14	**Salt spray test**	**(**AIS: 012/ IS10250) 96 hours
15	**EMC/EMI**	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

Sr. No	Test standards compliance	Specifications
		Note: In case of product is 'e' marked and a detailed test report is submitted (which includes above tests) no fresh verification is necessary
16	**Operating parameters**	• Supply voltage 24 V± 25%
17	**LED color test – dominant wave length amber**	AIS -012
18	**LED chromaticity coordinates**	Limit towards green: $y \leq x-0.120$ Limit towards red: $y \geq 0.390$ Limit towards white: $y \geq 0.790-0.670x$
		In accordance with CIE 127 condition B
19	**LED bulb/SMT intensity and viewing angle**	In accordance with CIE 127 condition B

Annexure 3: Diagnostic trouble codes (DTC) and Parameter Identifiers (PID) list

Appendix 1 – DTC code list of PIS signs

DTC code				Description
1	2	0	0	Over voltage
1	2	0	1	Low voltage
1	2	0	3	Over heat

Appendix 1.1 – PID code list of PIS signs

Example of PIDs code numbers for a LED sign. PIN code is Ascii characters.

PID code	Description
100	Hardware revision
101	Serial number
102	Boot loader SW revision
103	Application SW revision
104	Font library revision
105	CPU part number

PID code	Description
106	CPU qualification
107	CPU temperature range
108	Compilation of FW date and time
109	Flash update status
110	Test date and time
114	Article number sign level
115	Production date (production date)
116	End customer
117	Order number
118	Bus/vehicle type
119	Bus builder number (bus build)
208	Language
401	Board temp sensor
402	Internal CPU temp
600	Minimum temp CPU

PID code	Description
601	Maximum temp CPU
602	Maximum temp board
603	Minimum temp board
604	Maximum input power voltage
605	Minimum input power voltage
606	Operating hours
607	Number of resets

Appendix 1.2 – DTC code list of controller

DTC code				Comments
0	0	1	2	Watch dog reset
0	0	1	3	Low voltage reset
0	0	2	0	Lost communication, GPS satellite (GPS receiver is not available to the system.)
0	0	2	1	Invalid data, GPS signal invalid
0	0	2	2	GPS antenna error

0	0	2	5	USB, invalid USB mass storage device
0	0	2	6	USB, unknown USB device connected
0	0	2	7	USB, USB invalid file system
0	0	0	7	USB, overcurrent
0	2	0	0	Over voltage
0	2	0	1	Low voltage
0	2	0	3	Over heat

Appendix 1.3 – PID code list controller

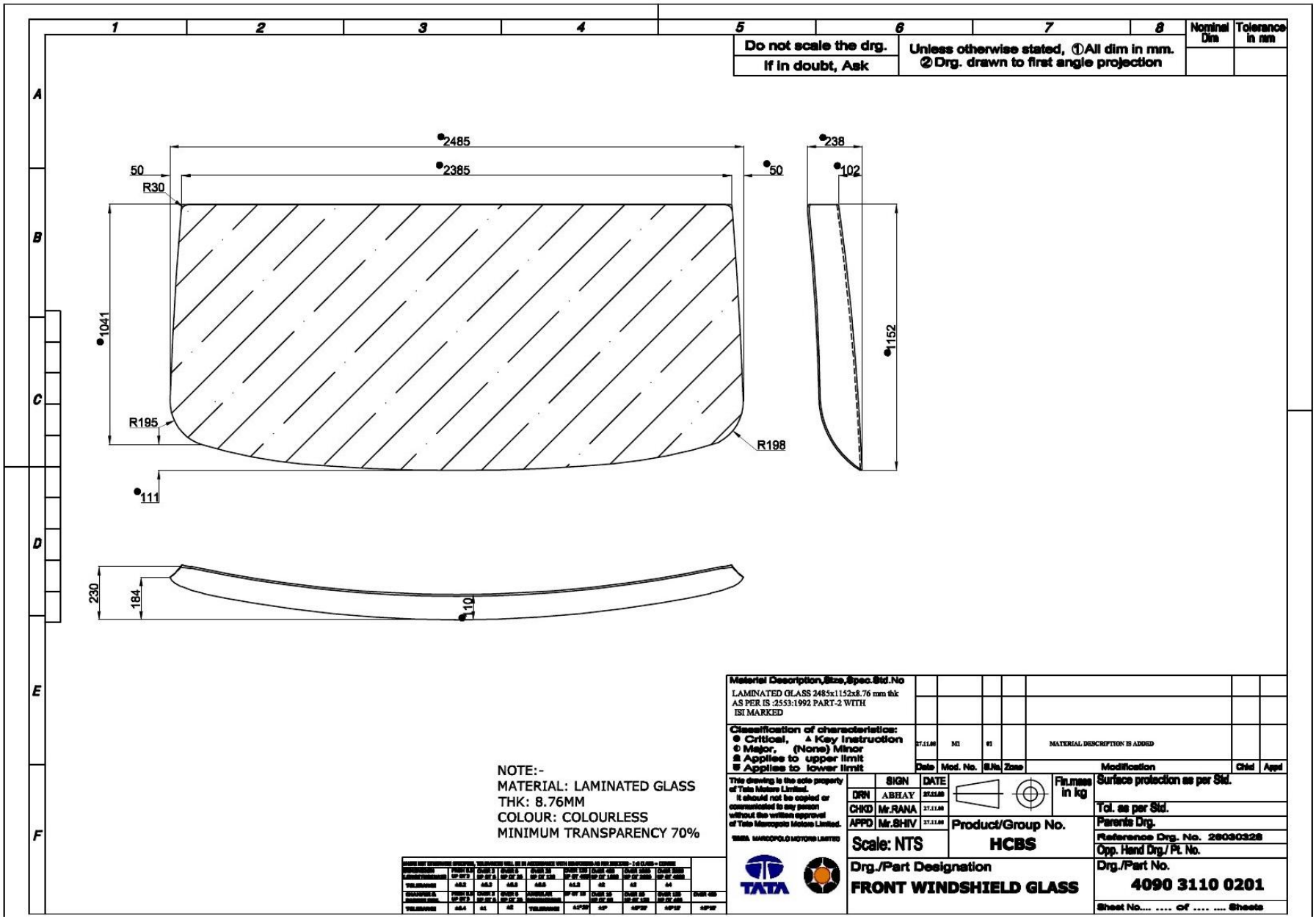
Example of PIDs code numbers for control unit. PIN code is Ascii characters.

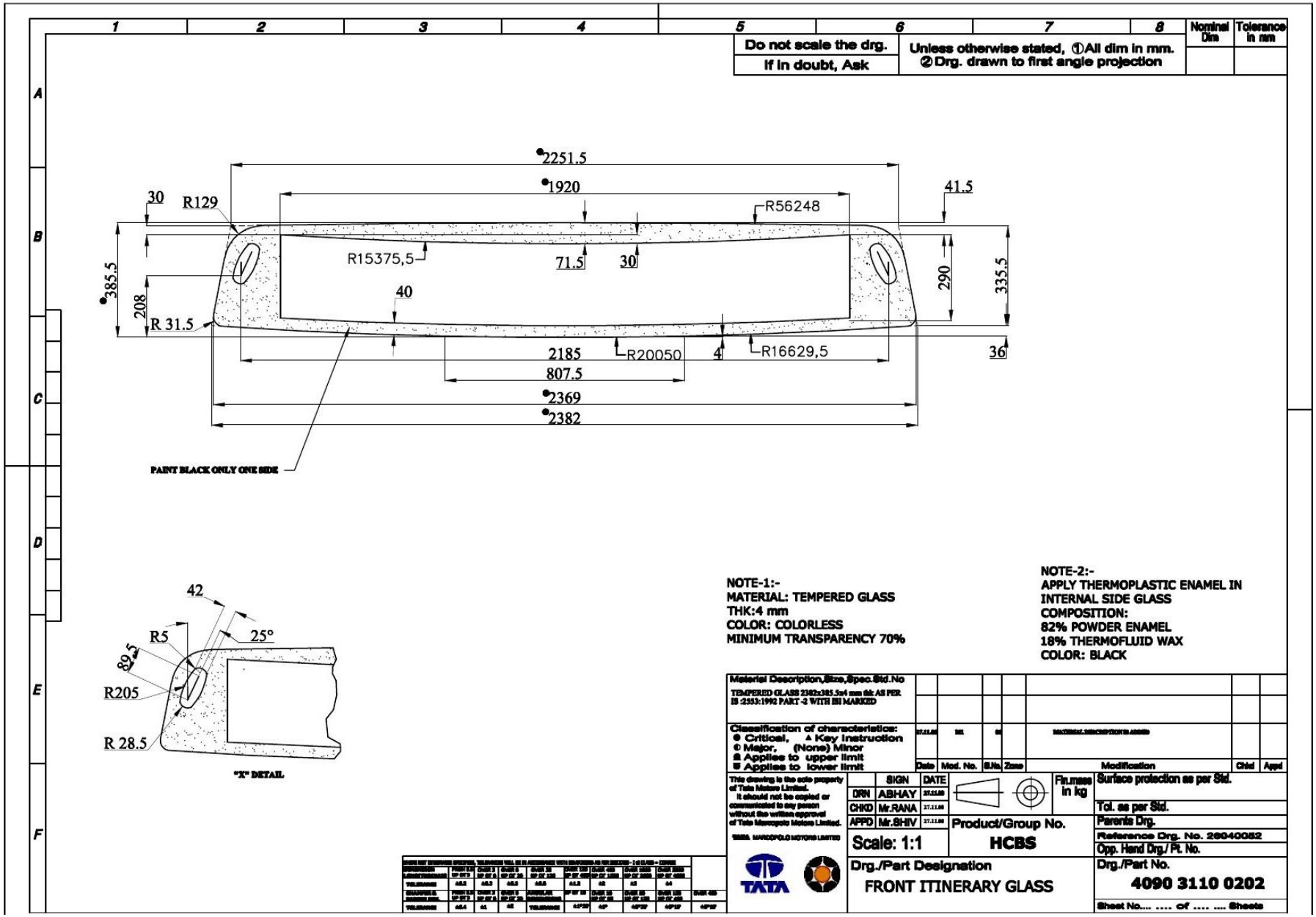
PID code	Description
100	Hardware revision
.i101	Serial number
102	Boot loader SW revision
103	Application SW revision
104	Font library revision

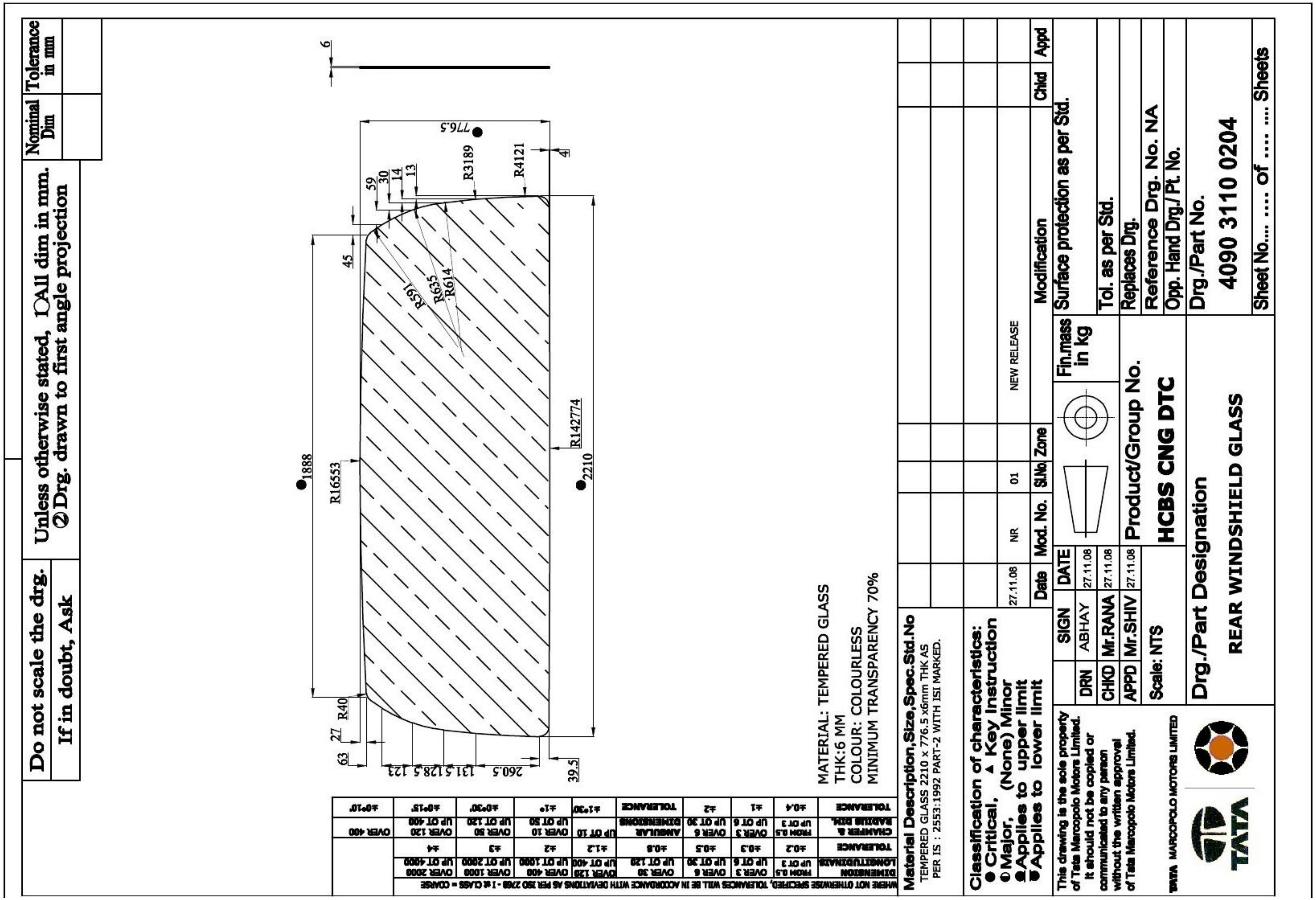
105	CPU part number
106	CPU qualification
107	CPU temperature range
108	Compilation of FW date and time
110	Test date and time

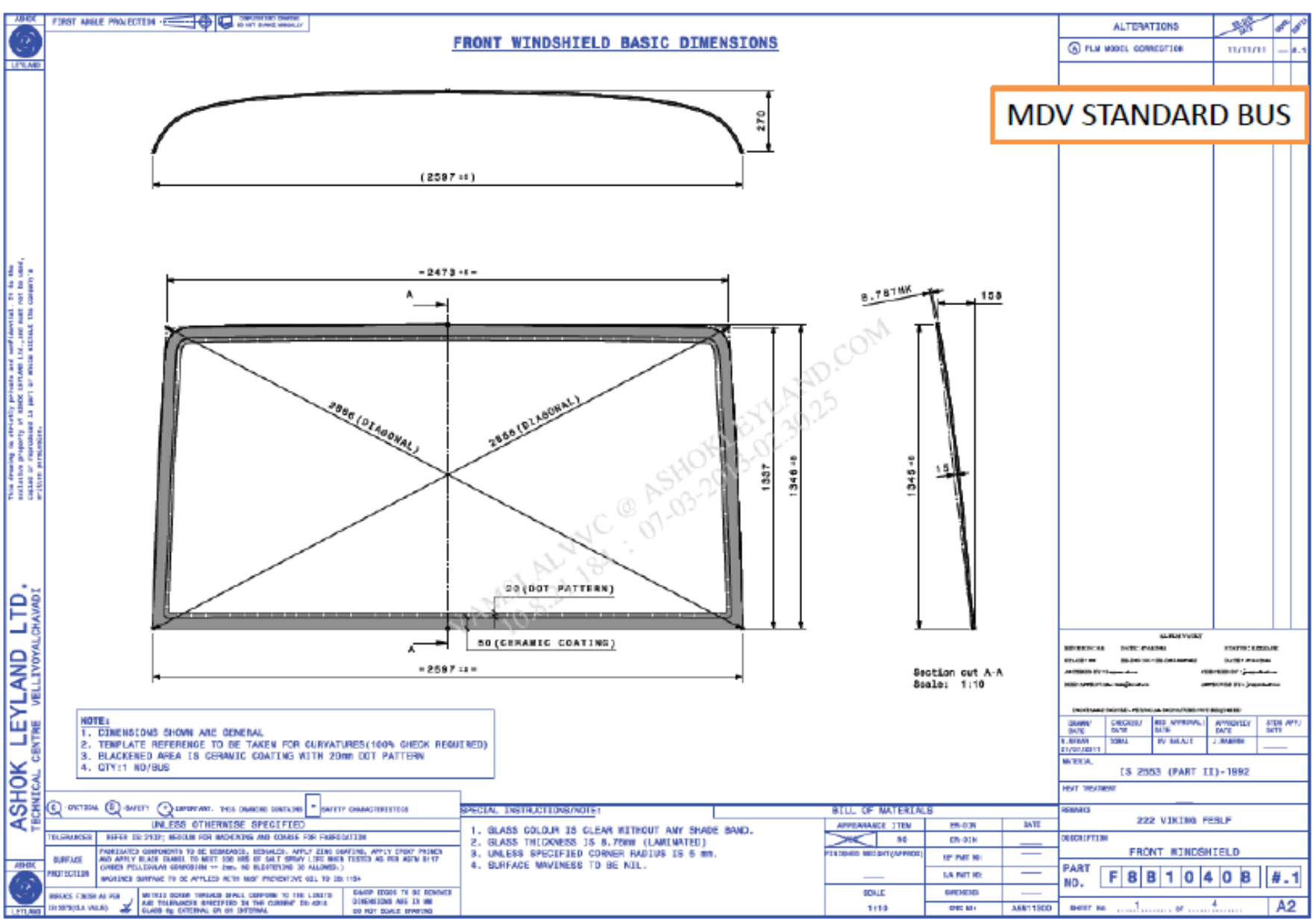
Annexure - 1

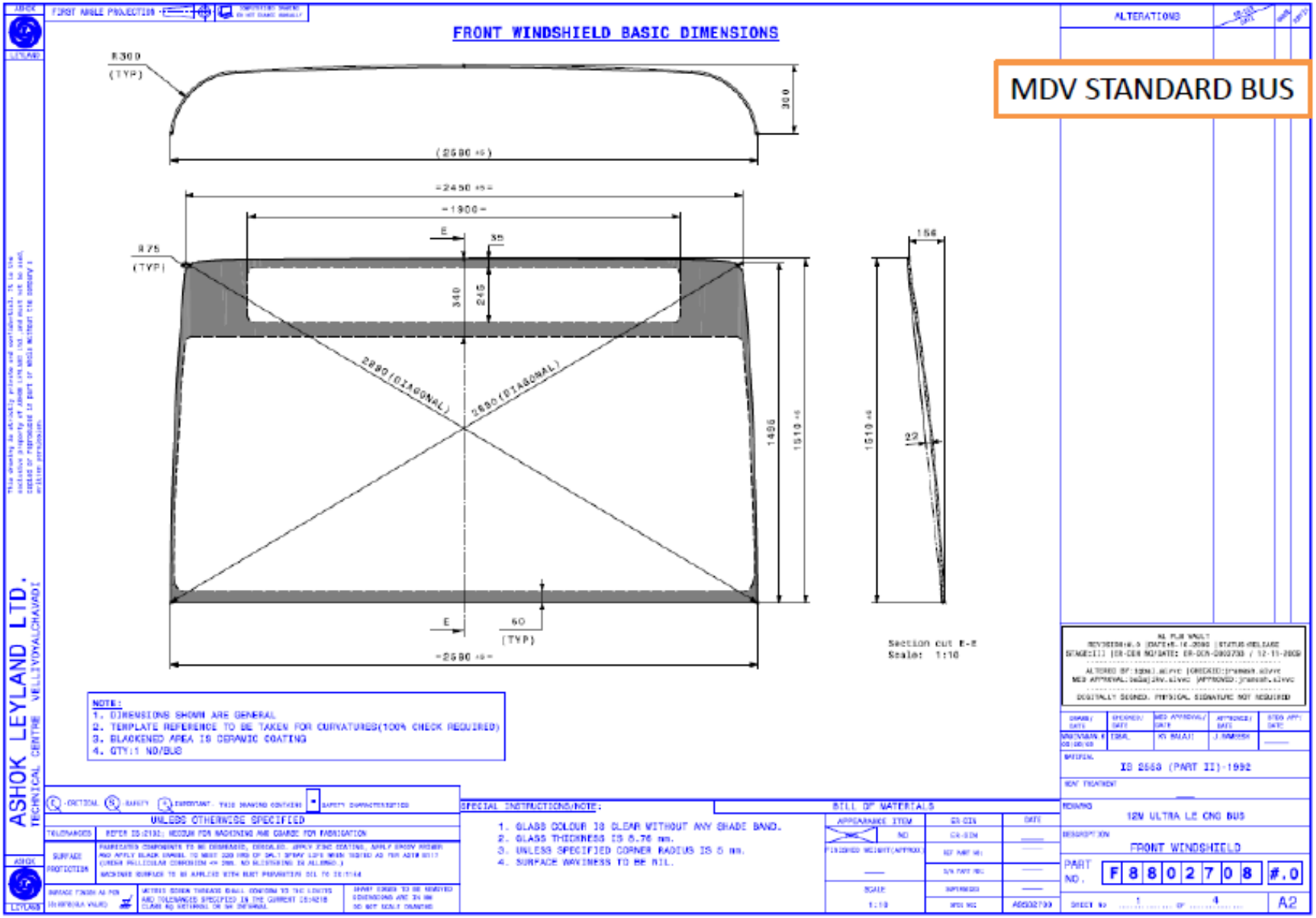
Windshield Designs

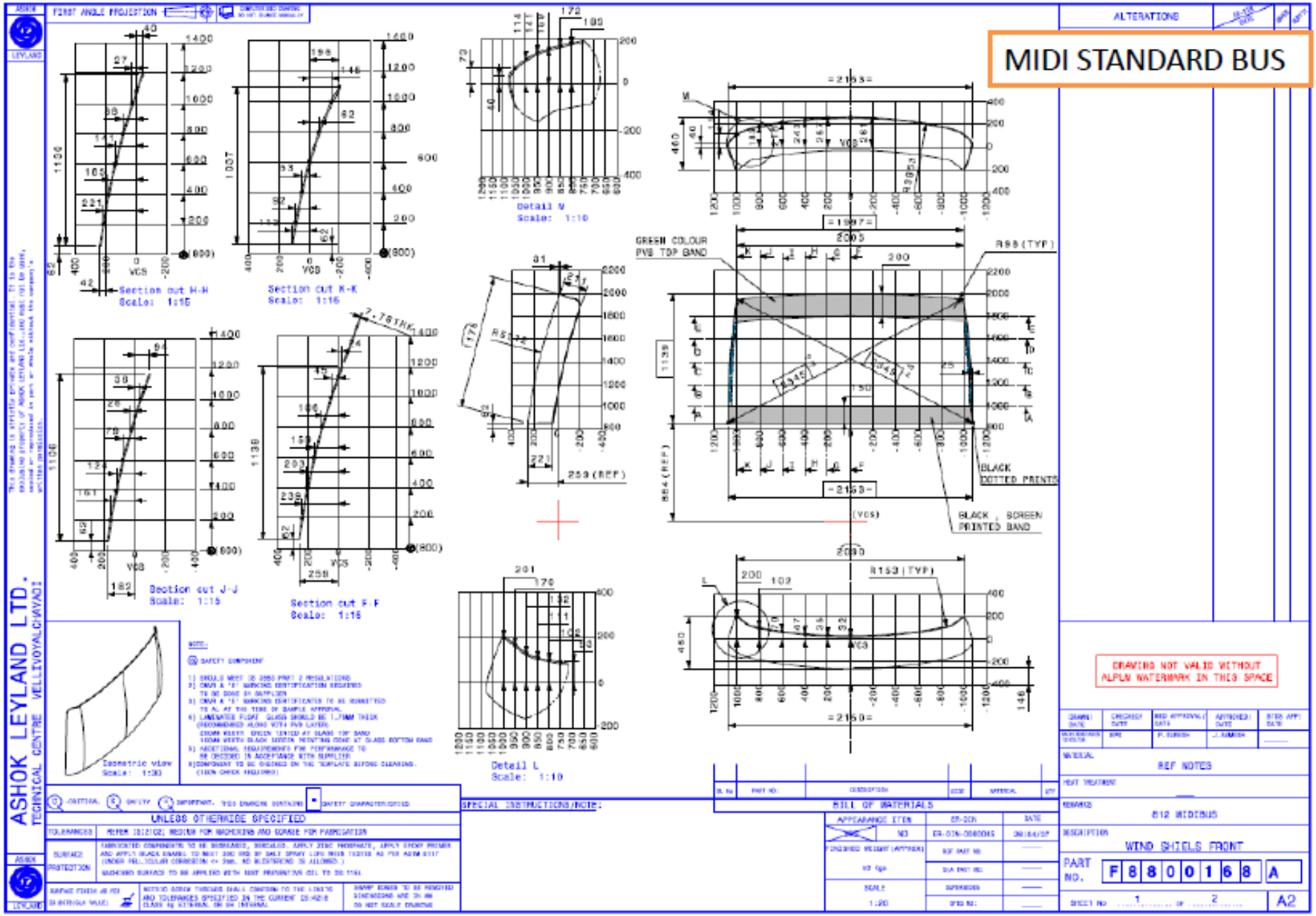

Do not scale the drg.
If in doubt, Ask
Unless otherwise stated, ①All dim in mm.
② Drg. drawn to first angle projection
Nominal Dim
Tolerance in mm
2485
2385
50
50
R30
1041
R195
R198
111
238
102
1152
230
184
10
NOTE:-
MATERIAL: LAMINATED GLASS
THK: 8.76MM
COLOUR: COLOURLESS
MINIMUM TRANSPARENCY 70%
Material Description,Size,Spec.Std.No
LAMINATED GLASS 2485x1152x8.76 mm thk
AS PER IS :2553:1992 PART-2 WITH
ISI MARKED
Classification of characteristics:
● Critical, ▲ Key Instruction
○ Major, (None) Minor
▲ Applies to upper limit
▼ Applies to lower limit
27.11.08
M1
01
MATERIAL DESCRIPTION IS ADDED
Date
Mod. No.
Sl.No
Zone
Modification
Chkd
Appd
This drawing is the sole property of Tata Motors Limited.
It should not be copied or communicated to any person without the written approval of Tata Motors Limited.
TATA MARCOPOLO MOTORS LIMITED
SIGN
DATE
DRN ABHAY 27.11.08
CHKD Mr.RANA 27.11.08
APPD Mr.SHIV 27.11.08
Fin.mass in kg
Product/Group No.
HCBS
Scale: NTS
Drg./Part Designation
FRONT WINDSHIELD GLASS
Surface protection as per Std.
Tol. as per Std.
Parents Drg.
Reference Drg. No. 28030328
Opp. Hand Drg./ Pt. No.
Drg./Part No.
4090 3110 0201
Sheet No.... .... of .... Sheets


Do not scale the drg.
If in doubt, Ask
Unless otherwise stated, ①All dim in mm.
②Drg. drawn to first angle projection
Nominal Dim
Tolerance in mm
2251.5
1920
30
R129
R56248
41.5
R15375,5
71.5
30
385.5
208
40
290
335.5
R 31.5
2185
R20050
4
R16629,5
36
807.5
2369
2382
PAINT BLACK ONLY ONE SIDE
42
R5
25°
89.5
R205
R 28.5
"X" DETAIL
NOTE-1:-
MATERIAL: TEMPERED GLASS
THK:4 mm
COLOR: COLORLESS
MINIMUM TRANSPARENCY 70%
NOTE-2:-
APPLY THERMOPLASTIC ENAMEL IN INTERNAL SIDE GLASS
COMPOSITION:
82% POWDER ENAMEL
18% THERMOFLUID WAX
COLOR: BLACK
Material Description,Size,Spec.Std.No
TEMPERED GLASS 2382x385.5x4 mm thk AS PER IS :2553:1992 PART -2 WITH BIS MARKED
Classification of characteristics:
● Critical, ▲ Key Instruction
© Major, (None) Minor
≙ Applies to upper limit
≚ Applies to lower limit
Date
Mod. No.
Sl.No.
Zone
Modification
Chkd
Appd
This drawing is the sole property of Tata Motors Limited. It should not be copied or communicated to any person without the written approval of Tata Marcopolo Motors Limited.
TATA MARCOPOLO MOTORS LIMITED
SIGN
DATE
DRN ABHAY
CHKD Mr.RANA
APPD Mr.SHIV
Fin.mass in kg
Product/Group No.
HCBS
Scale: 1:1
Drg./Part Designation
FRONT ITINERARY GLASS
Surface protection as per Std.
Tol. as per Std.
Parents Drg.
Reference Drg. No. 28040052
Opp. Hand Drg./ Pt. No.
Drg./Part No.
4090 3110 0202
Sheet No.... .... of .... Sheets

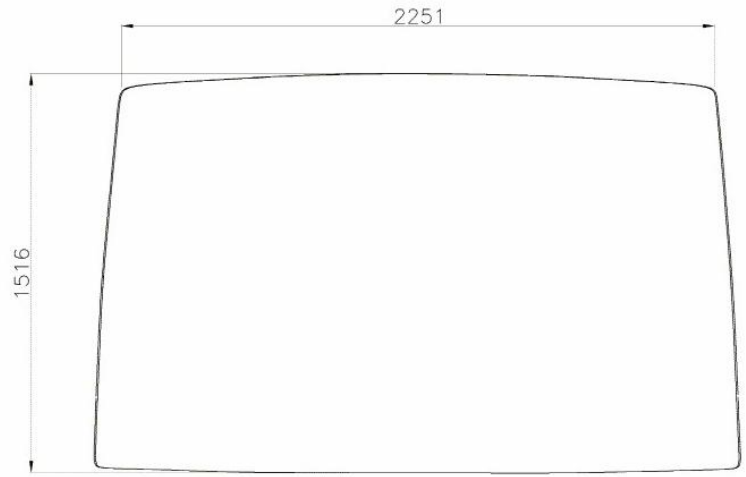

Do not scale the drg.
If in doubt, Ask
Unless otherwise stated, 1 All dim in mm. 2 Drg. drawn to first angle projection
Nominal Dim
Tolerance in mm
1888
R16553
63
27
R40
45
59
30
14
13
R591
R635
R614
R3189
776.5
R4121
4
6
123
128.5
131.5
260.5
39.5
R142774
2210
MATERIAL: TEMPERED GLASS
THK:6 MM
COLOUR: COLOURLESS
MINIMUM TRANSPARENCY 70%
Material Description,Size,Spec.Std.No
TEMPERED GLASS 2210 x 776.5 x6mm THK AS PER IS : 2553:1992 PART-2 WITH ISI MARKED.
Classification of characteristics:
Critical, Key Instruction
Major, (None) Minor
Applies to upper limit
Applies to lower limit
27.11.08
NR
01
NEW RELEASE
Date
Mod. No.
Sl.No.
Zone
Modification
Chkd
Appd
This drawing is the sole property of Tata Marcopolo Motors Limited. It should not be copied or communicated to any person without the written approval of Tata Marcopolo Motors Limited.
SIGN
DATE
DRN
ABHAY
27.11.08
CHKD
Mr.RANA
27.11.08
APPD
Mr.SHIV
27.11.08
Scale: NTS
Fin.mass in kg
Surface protection as per Std.
Tol. as per Std.
Replaces Drg.
Reference Drg. No. NA
Opp. Hand Drg./ Pt. No.
Product/Group No.
HCBS CNG DTC
TATA MARCOPOLO MOTORS LIMITED
Drg./Part Designation
REAR WINDSHIELD GLASS
Drg./Part No.
4090 3110 0204
Sheet No.... .... of .... Sheets


FRONT WINDSHIELD BASIC DIMENSIONS
MDV STANDARD BUS
ALTERATIONS
A FLM MODEL CORRECTION
270
(2597 ±5)
2473 ±5
2886 (DIAGONAL)
2886 (DIAGONAL)
1337
1346 ±5
20 (DOT PATTERN)
50 (CERAMIC COATING)
2587 ±5
8.787MM
155
1345 ±5
15
Section cut A-A
Scale: 1:10
NOTE:
1. DIMENSIONS SHOWN ARE GENERAL
2. TEMPLATE REFERENCE TO BE TAKEN FOR CURVATURES(100% CHECK REQUIRED)
3. BLACKENED AREA IS CERAMIC COATING WITH 20mm DOT PATTERN
4. QTY:1 NO/BUS
SPECIAL INSTRUCTIONS/NOTES:
1. GLASS COLOUR IS CLEAR WITHOUT ANY SHADE BAND.
2. GLASS THICKNESS IS 8.78mm (LAMINATED)
3. UNLESS SPECIFIED CORNER RADIUS IS 6 mm.
4. SURFACE WAVINESS TO BE NIL.
BILL OF MATERIALS
UNLESS OTHERWISE SPECIFIED
[S 2553 (PART II)-1992
222 VIKING PESLP
FRONT WINDSHIELD
PART NO. F8B10408 #.1
SCALE 1:10
A2
ASHOK LEYLAND LTD.
TECHNICAL CENTRE VELLIYOYALCHAVADI


FRONT WINDSHIELD BASIC DIMENSIONS
MDV STANDARD BUS
R300 (TYP)
300
(2580 ±5)
=2450 ±5=
=1900=
R75 (TYP)
E
35
340
245
2880(DIAGONAL)
2880(DIAGONAL)
1496
1510 ±5
156
12
Section cut E-E
Scale: 1:10
E
60 (TYP)
=2580 ±5=
NOTE:
1. DIMENSIONS SHOWN ARE GENERAL
2. TEMPLATE REFERENCE TO BE TAKEN FOR CURVATURES(100% CHECK REQUIRED)
3. BLACKENED AREA IS CERAMIC COATING
4. QTY:1 NO/BUS
ALTERATIONS
ASHOK LEYLAND LTD.
TECHNICAL CENTRE VELLIVOYALCHAVADI
UNLESS OTHERWISE SPECIFIED
SPECIAL INSTRUCTIONS/NOTE:
1. GLASS COLOUR IS CLEAR WITHOUT ANY SHADE BAND.
2. GLASS THICKNESS IS 5.76 mm.
3. UNLESS SPECIFIED CORNER RADIUS IS 5 mm.
4. SURFACE WAVINESS TO BE NIL.
BILL OF MATERIALS
IS 2553 (PART II)-1992
12M ULTRA LE CNG BUS
FRONT WINDSHIELD
PART NO. F880270 8 #.0
A2


MIDI STANDARD BUS
ASHOK LEYLAND LTD.
TECHNICAL CENTRE VELLIVOYALCHAVADI
FIRST ANGLE PROJECTION
ALTERATIONS
Section cut H-H
Scale: 1:15
Section Cut K-K
Scale: 1:15
Detail V
Scale: 1:10
GREEN COLOUR PVB TOP BAND
R88 (TYP)
BLACK DOTTED PRINTS
BLACK , SCREEN PRINTED BAND
Section cut J-J
Scale: 1:15
Section cut F-F
Scale: 1:15
Detail L
Scale: 1:10
R153 (TYP)
Isometric view
Scale: 1:30
SPECIAL INSTRUCTIONS/NOTE:
BILL OF MATERIALS
DRAWING NOT VALID WITHOUT ALPLM WATERMARK IN THIS SPACE
MATERIAL
REF NOTES
HEAT TREATMENT
REMARKS
812 MIDIBUS
DESCRIPTION
WIND SHIELD FRONT
PART NO.
F 8 8 0 0 1 6 8 A
A2

Engineering Release Notice (ERN)	Location	Change description A=Added D=Deleted	Document release status: RELEASED
			Date / Modification count



BASIC DIMENSION: T=8.5

TOLERANCES UNLESS OTHERWISE STATED SS-ISO 2768-1-C

MAIN INFORMATION OF THE PART:
SEE PART VERSION REPORT

SYMBOLS, DESIGNATIONS AND GENERAL DRAWING METHODS
STD 101-0005

METHOD E, FIRST ANGLE PROJECTION METHOD

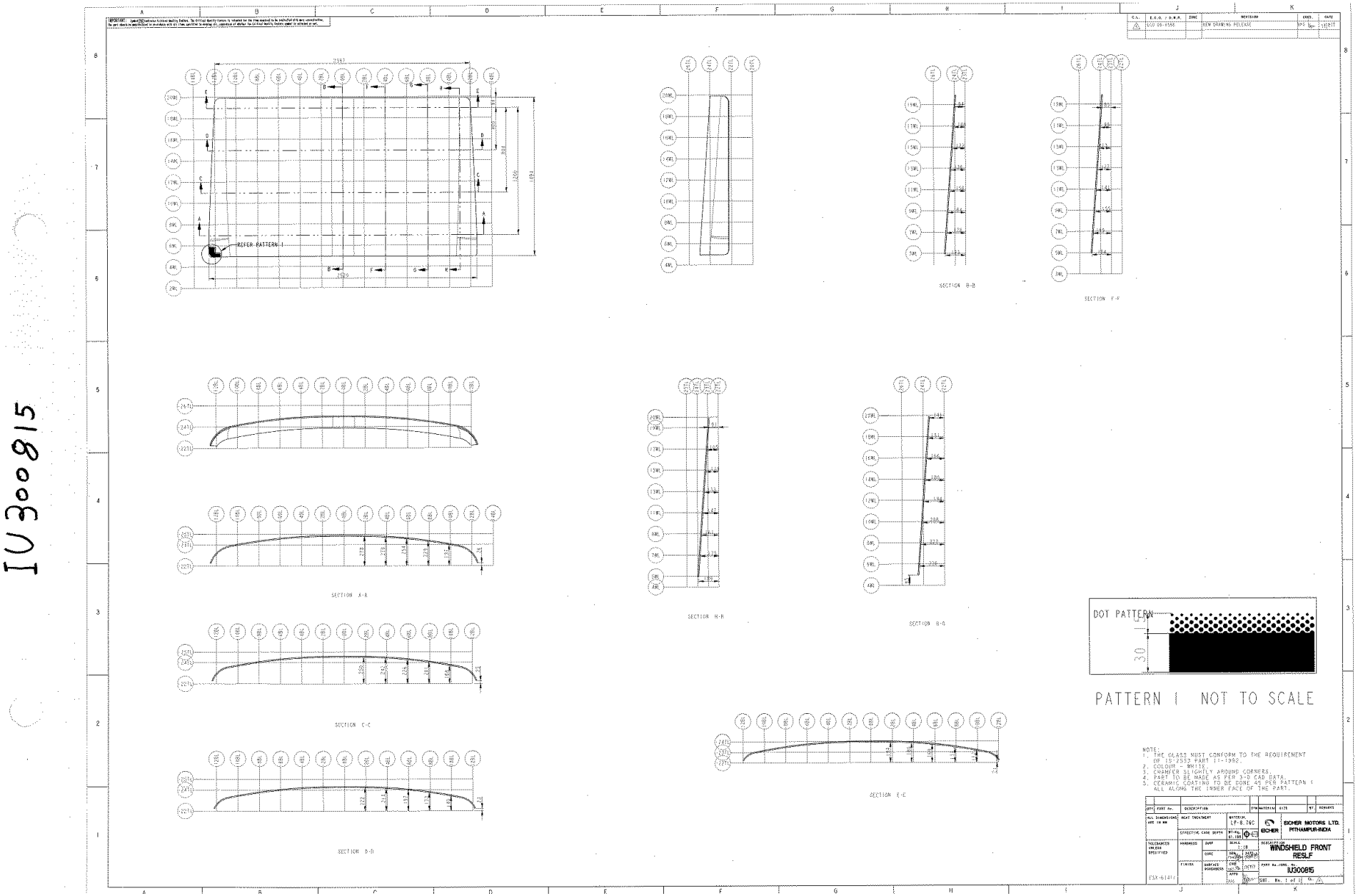
Document title: WINDSHIELD, FWS LAMINATED, CLEAR 8400, INDIA

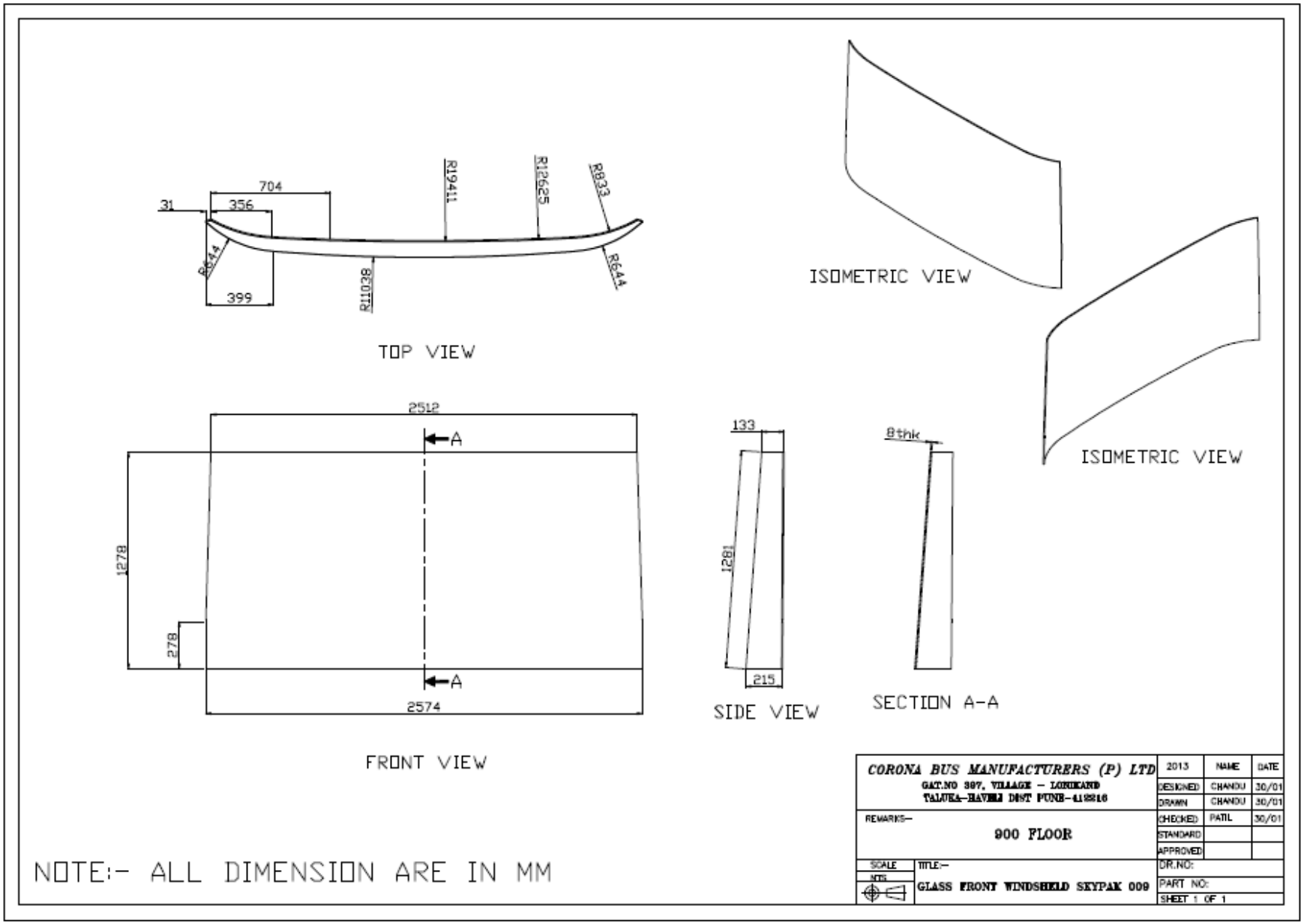
Document type:

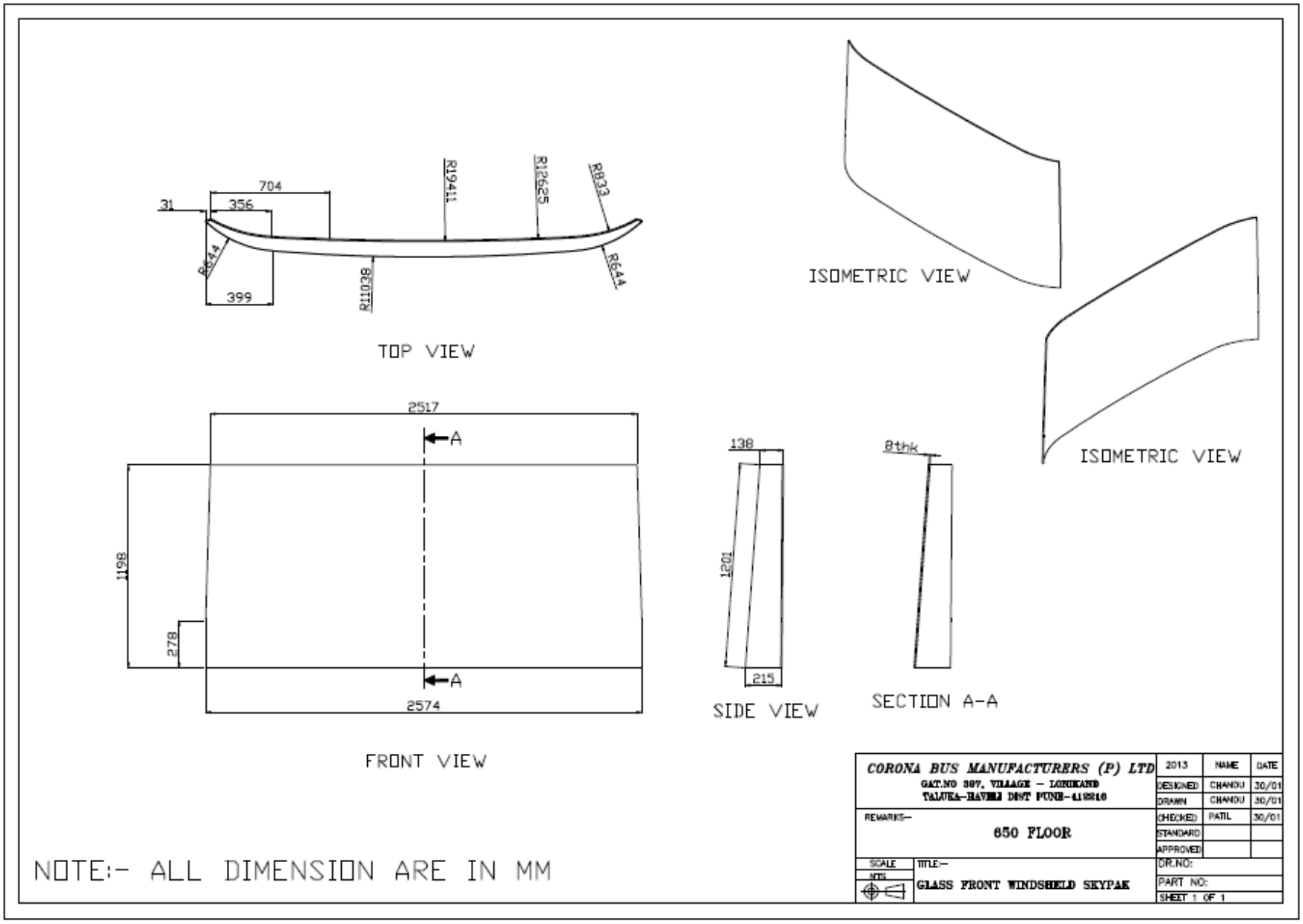
VOLVO
Volvo Bus Corporation

Owner domain/Document prefix:

Document No	Issue index	Sheet No
70398148	01	


IU300815
REFER PATTERN-1
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
DOT PATTERN
PATTERN 1 NOT TO SCALE
NOTE:
1. THE GLASS MUST CONFORM TO THE REQUIREMENT OF IS:7552 PART 11-1982.
2. COLOUR - WHITE.
3. CHAMFER SLIGHTLY AROUND CORNERS.
4. PART TO BE MADE AS PER X-Y-Z CAD DATA.
5. CERAMIC COATING TO BE DONE AS PER PATTERN 1 ALL ALONG THE INNER FACE OF THE PART.
EICHER MOTORS LTD. PITHAMPUR-INDIA
WINDSHIELD FRONT RESLF
IU300815


704
31
356
R19411
R12625
R833
R644
R644
399
R11038
TOP VIEW
ISOMETRIC VIEW
ISOMETRIC VIEW
2512
A
1278
278
A
2574
FRONT VIEW
133
1281
215
SIDE VIEW
8thk
SECTION A-A
NOTE:- ALL DIMENSION ARE IN MM
CORONA BUS MANUFACTURERS (P) LTD
GAT.NO 307, VILLAGE – LONIKAND
TALUKA–HAVELI DIST PUNE–412216
REMARKS–
900 FLOOR
SCALE
NTS
TITLE:–
GLASS FRONT WINDSHIELD SKYPAK 009
2013
NAME
DATE
DESIGNED
CHANDU
30/01
DRAWN
CHANDU
30/01
CHECKED
PATIL
30/01
STANDARD
APPROVED
DR.NO:
PART NO:
SHEET 1 OF 1


704
356
31
R19411
R12625
R833
R644
R644
399
R11038
TOP VIEW
ISOMETRIC VIEW
ISOMETRIC VIEW
2517
A
A
1198
278
2574
FRONT VIEW
138
1201
215
SIDE VIEW
8thk
SECTION A-A
NOTE:- ALL DIMENSION ARE IN MM
CORONA BUS MANUFACTURERS (P) LTD
GAT.NO 387, VILLAGE – LOHEGAON
TALUKA–HAVELI DIST PUNE–412216
2013
NAME
DATE
DESIGNED
CHANDU
30/01
DRAWN
CHANDU
30/01
CHECKED
PATIL
30/01
STANDARD
APPROVED
REMARKS–
650 FLOOR
SCALE
NTS
TITLE:–
GLASS FRONT WINDSHIELD SKYPAK
DR.NO:
PART NO:
SHEET 1 OF 1

Annexure - 2

Figures

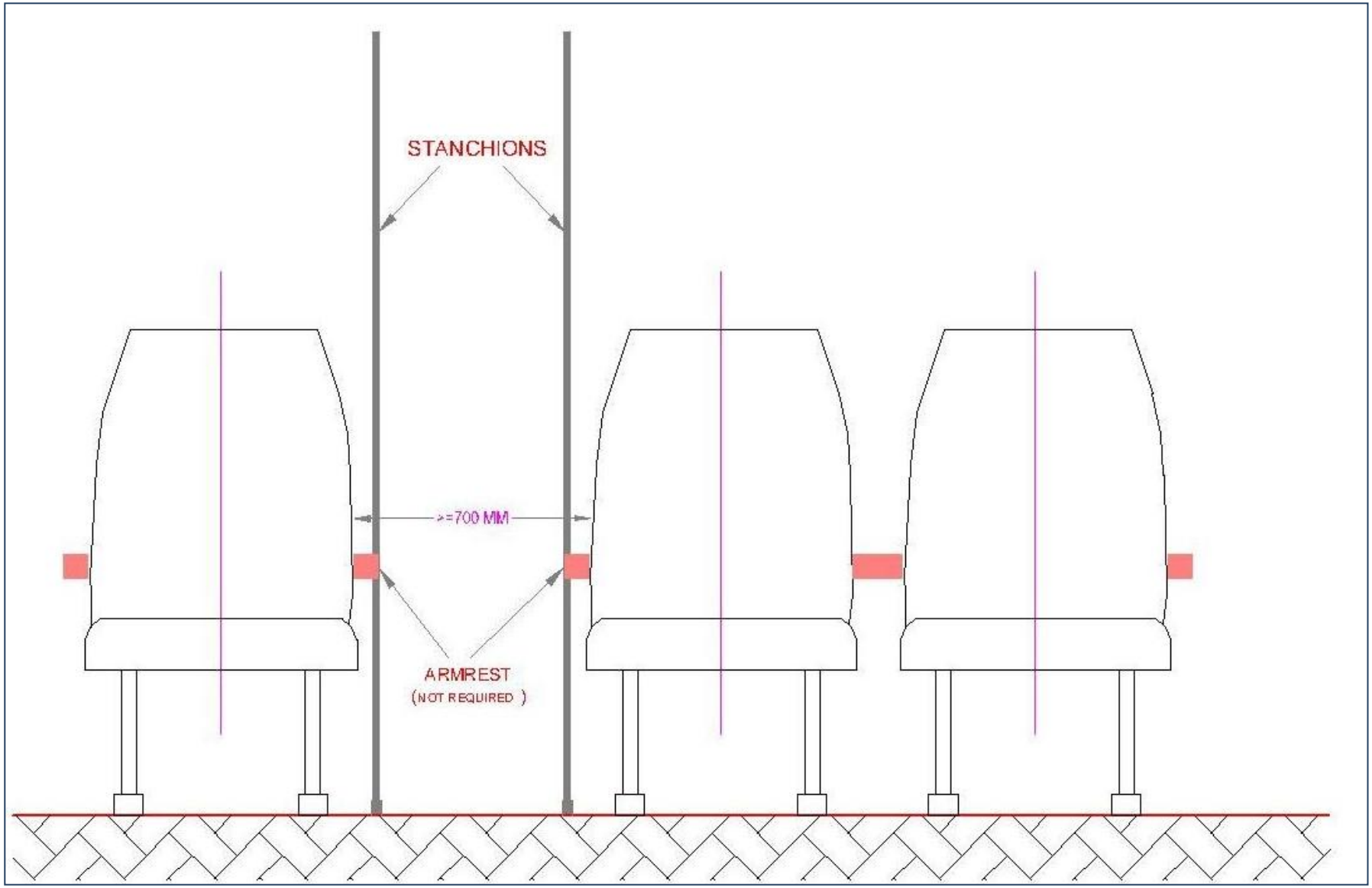


Figure - 01

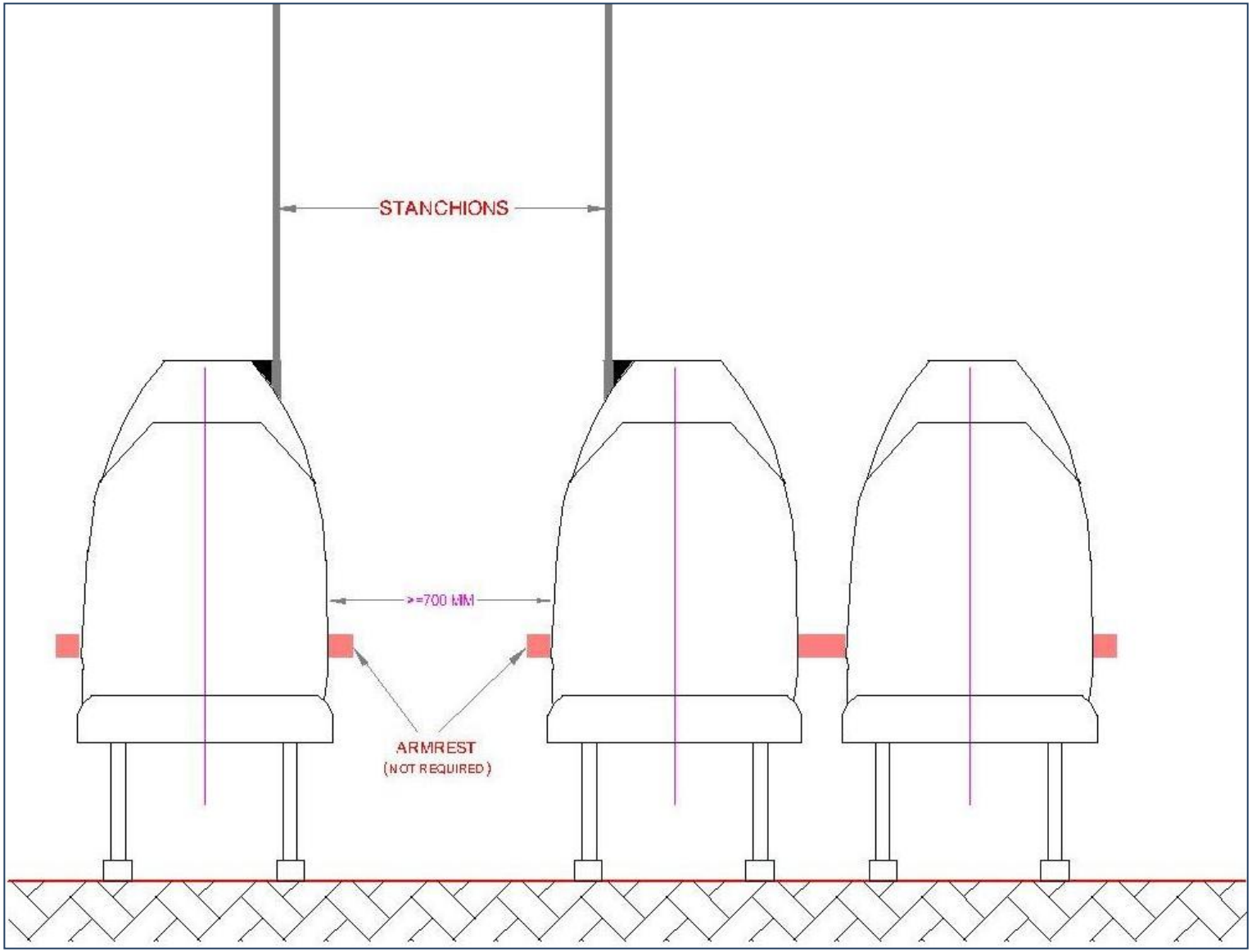
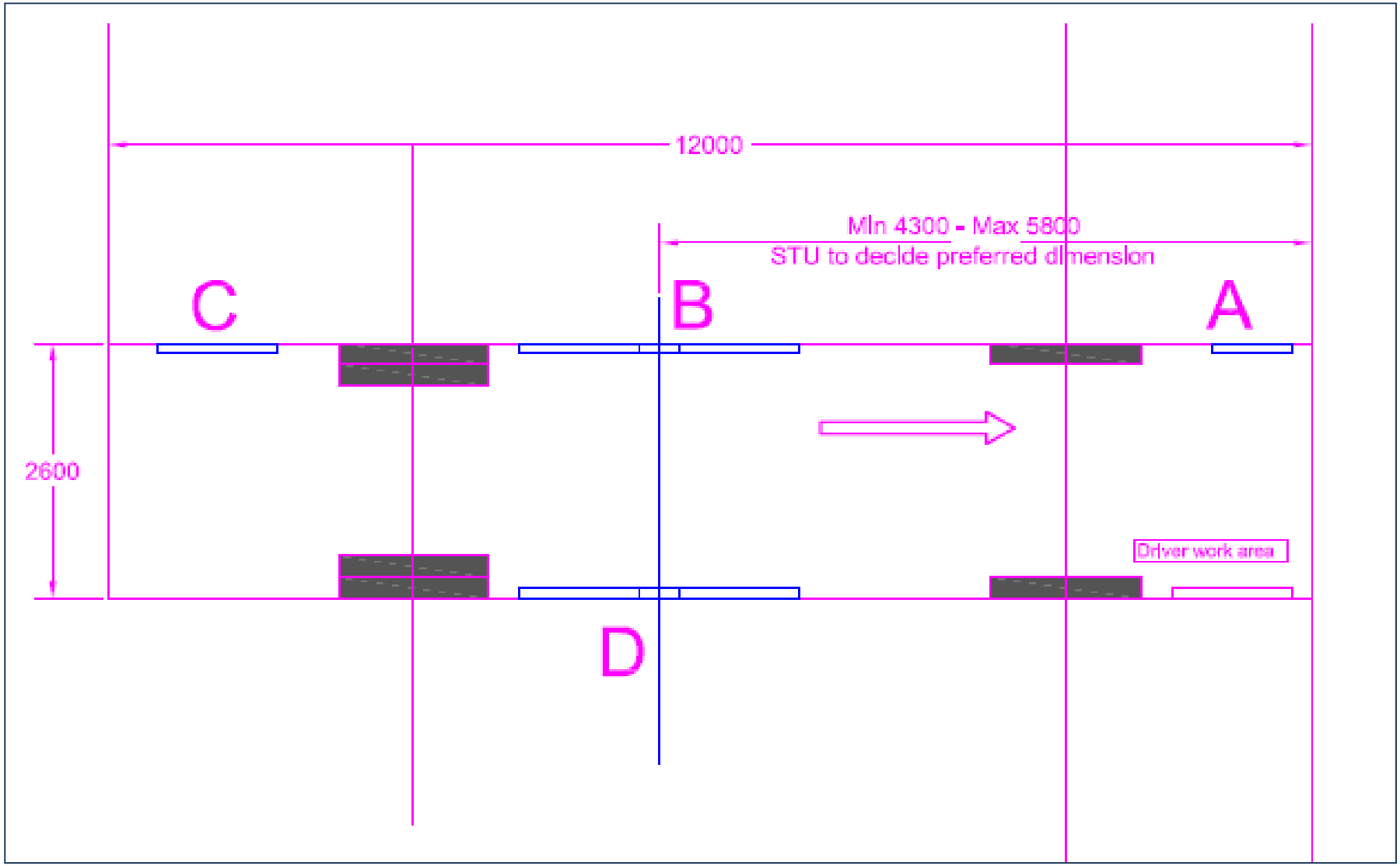


Figure - 02

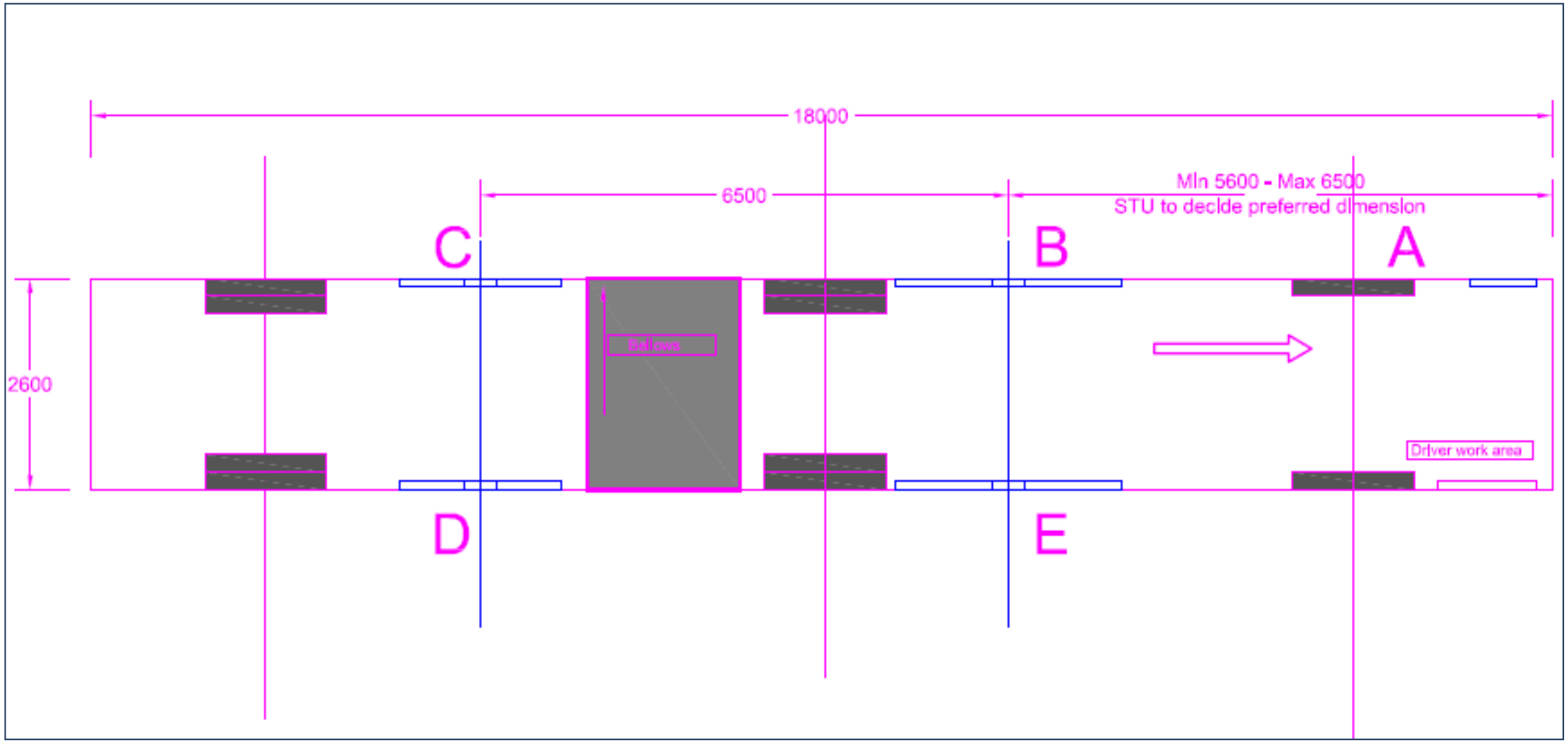


12 m BRT Standard Bus

(Refer guideline for how to select doors and width)

(Guidelines for how to select door location) 12 m BRT Standard Bus						
			Station Door Details			
Bus Gates Details			Platform Ht			
Operation Option	Options for Bus Gate Locations for station position	Description	900			
			Near Side			Off Side
			Front	Middle	Rear	Middle
I	BRTS with dedicated corridor only with stations on either side					
		Near Side Gates	A	B	C	N/A
		Width of Door				
		Option 1	800	1200 (N/A)	1200 (N/A)	
		Option 2	1200	1500		
		Option 3		1200/1200 *		
		Steps Required Y/N If Y, then no of Steps (No)	Y (2)	N	N	
		Off Side Gates	N/A			D
		Width Option 1				1200/1200 *
		Steps Required Y/N				N
II	BRTS with BRT corridor + extn in Mixed Traffic (Off Side -Level Boarding + Near Side - non-level boarding)					
		Near Side Gates	A	B	C	N/A
		Width of Door				
		Option 1	800	1200 (N/A)	1200	
		Option 2	1200	1500 (N/A)		
		Option 3		1200/1200 (N/A)		
		Steps Required Y/N If Y, then no of Steps (No)	Y (2)	N	Y (2)	
		Off Side Gates	N/A			D
		Width Option				1200/1200 *
		Steps Required Y/N				N

Note: * There are two doors with partition as per specification

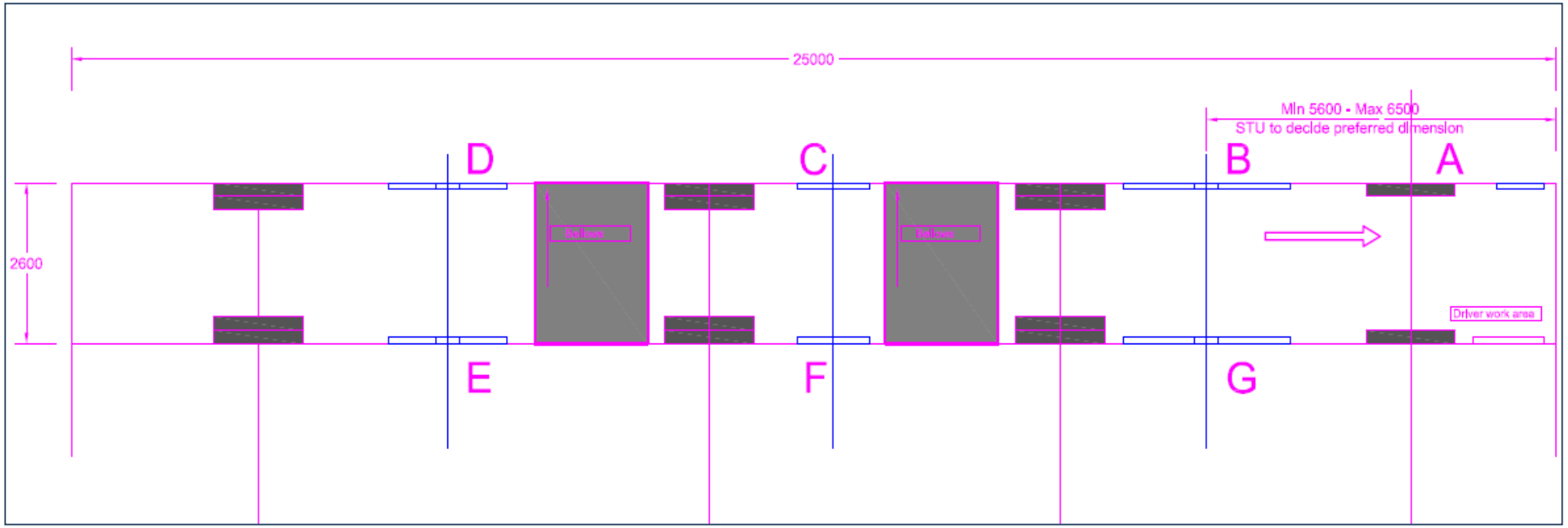


18 m BRT Articulated Bus

(Refer guideline for how to select doors and width)

(Guidelines for how to select door location) 18 m BRT Articulated Bus								
			Station Door Details					
Bus Gates Details			Platform Ht					
Operation Option	Options for Bus Gate Locations for station position	Description	900					
			Near Side			Off Side		
			Front	Tractor	Trailer	Tractor	Trailer	
I	BRTS with dedicated corridor only with stations on either side							
		Near Side Gates	A	B	C	N/A		
		Width of Door						
		Option 1	800	1200/1200 *	1200			
		Option 2	1200		1500			
		Option 3			800/800 *			
		Steps Required Y/N If Y, then no of Steps (No)	Y (2)	N	N			
		Off Side Gates	N/A			E	D	
		Width of Door						
		Option 1				1200/1200 *	800/800 *	
		Option 2					1500	
		Steps Required Y/N				N	N	
II	BRTS with BRT corridor + extn in Mixed Traffic (Off Side -Level Boarding + Near Side - non-level boarding)							
		Near Side Gates	A	BC	D	N/A		
		Width Option						
		Option 1	800	1200/1200 (N/A)	1200			
		Option 2	1200		1500 (N/A)			
		Option 3			800/800 (N/A)			
		Steps Required Y/N	Y (2)		Y (2)			
		Off Side Gates	N/A			FG	E	
		Option 1				1200/1200 *	800/800 *	
		Option 2					1500	
		Steps Required Y/N				N	N	

Note: * There are two doors with partition as per specification



25 m BRT Bi-Articulated Bus

(Refer guideline for how to select doors and width)

(Guidelines for how to select door location) 25 m BRT Bi- Articulated Bus										
			Station Door Details							
Bus Gates Details			Platform Ht							
Operation Option	Options for Bus Gate Locations for station position	Description	900							
			Near Side					Off Side		
			Front	Tractor	Trailer 1	Trailer 2	Tractor	Trailer 1	Trailer 2	
I		Near Side Gates	A	B	C	D	N/A			
		Width of Door								
		Option 1	800	1200/1200	1200	800/800				
		Option 2	1200			1500				
		Steps Required Y/N If Y, then no of Steps (No)	Y (2)	N	N	N				
		Off Side Gates	N/A				G	F	E	
		Width Option 1								
		Option 1					1200/1200	1200	800/800	
		Option 2							1500	
		Steps Required Y/N					N	N	N	
II		Near Side Gates	A	B	C	D	N/A			
		Width Option								
		Option 1	800	1200/1200 (N/A)	1200					
		Option 2	1200			1500 (N/A)				
		Option 3				800/800 (N/A)				
		Steps Required Y/N	Y (2)	N	Y (2)	N				
		Off Side Gates	N/A				G	F	E	
		Width Option 1								
		Option 1					1200/1200	1200	800/800	
		Option 2							1500	
		Steps Required Y/N					N	N	N	

Annexure - 3

Design Type Approval

	Material Strength Requirements	
S. No.	Description	Specifications
15	Bus body	
15.1	Design type approval	
a	Design type approval- all bus body structures & structural aggregates be designed to fulfil the loading, operating & performance parameters using finite element analysis or any other analytic technique for: Strength Stiffness Structural Stability Vibration Safety	Required
15.2	Structural performance	
a	Bus structure to meet requirements of:	
i	Body structure strength test- each type of vehicle be subjected to roll over test on complete vehicle/specified representative section thereof or to an alternate method approved by the test agency	As per AIS 052
ii	Stability	As per AIS 052
iii	Deflection	√
iv	Vibrations	√
v	Roll over protection	√
vi	Joint strength- body panel joints meet requirements of holding the joined panel when subjected to force of 60% of tensile strength of weakest joined body panel.	As per AIS 052

	Material Strength Requirements	
S. No.	Description	Specifications
b	Various loads:	
i	Normal loads (static) = Number of Passenger*weight of Passenger (68 Kgs.) + Passenger luggage weight (7 Kgs). (Besides the vehicle related loads).	√
ii	Bump loads: # Bump height = As per relevant BIS/Indian Road Congress guidelines. # Case I: single wheel on bump/pot hole. # Case II: diagonally opposite wheels on Bump/Pot hole. # Case III: both wheels (front & rear) on bump/pot hole.	√
iii	Braking loads: 0.6g (applied together). Horizontal = 0.6g load, Vertical = 1g load	√
c	Bus body structure evaluation by a & or b	As under
i	Physical testing or	As per AIS 052
ii	Finite element method	As per AIS 052
d	Required performance values/data (minimum) for above load conditions:	As under
i	Strength (factor of safety) (tolerance -10%)	≥ 3 i.e. design stress ≥ 1/3rdof yield stress
ii	Stiffness (deflection) mm	5mm
iii	Vibrations (lowest natural frequency) hertz	5Hz
iv	Roll over tests with the bus rolling from ground level instead of a raised platform. Angular velocity should not exceed 5 degrees/second. All other procedure as per AIS031	(i) Unstable position should not occur before 35°. (ii) No part of structure intrudes into residual space.
	1. Bus tilted to its unstable position	
	2. Bus allowed falling freely under gravity from this	

	Material Strength Requirements	
S. No.	Description	Specifications
	position.	
	3. GVW of the bus to be considered	
v	4. Energy absorbed by the structure {E_R =Reference energy-- potential energy of the bus in its (unstable) equilibrium position). ER = M*g*h Where M= Effective weight of the bus, g = Acceleration due to gravity, h= Height of C.G. above ground level in (unstable) equilibrium position.}.	0.75 ER
vi	Buckling factor	≥ 4

Annexure - 4

Test procedure for evaluation of AC system performance

1.0 Scope:-

This test procedure is applicable for testing the Air Conditioning system performance at hot ambient and very hot ambient condition on intracity urban bus in a climatic hot chamber. This procedure does not cover durability aspects of Air conditioning system.

2.0 Test Conditions:-

2.1 The performance of bus air conditioning system is evaluated in the following operating conditions

2.2 Test shall be carried out in climatic hot chamber, on stationary bus in neutral (gear)

2.3 Test RPM: Average of two corresponding engine RPM correlated to vehicle speed of 40 KMPH for two successive gears recommended by the manufacturer. Test RPM shall have a tolerance of + 50 RPM

2.4 AC Control Settings:-

a)	Blower speed	:	Maximum speed
b)	Temperature control	:	Maximum cooling
c)	Air intake	:	Recirculation mode
d)	Mode button	:	Cooling

2.5 **Environment / Ambient condition:-**

a)	Ambient Temperature	:	42±2°C (Hot ambient_Test Condition 1)
		:	48±2°C (Very hot ambient_Test Condition 2)
b)	RH	:	40±5% for both test conditions.

2.6 **Test Duration:-**

a)	Hot soaking time	:	90 minutes.

b) Test duration after start of engine and AC system : 30 minutes (Hot ambient_Test Condition1)
40 minutes (Very hot ambient_Test condition2)

3.0 Test Procedure:-

3.1 The bus under test shall be instrumented for the air conditioning performance evaluation (refer Annexure A for instrumentation inside the bus).

3.2 After instrumentation is complete, the bus shall be parked inside the climatic hot chamber with the front end facing the wind simulation fan. Engine and AC system is OFF.

3.3 If bus is equipped with a heating system, ensure the bus heating system is switched off during the trials. If bus is equipped with automatic temperature control, then ensure 'cooling' mode is selected.

3.4 The climatic hot chamber shall be started.

3.5 The environment / ambient conditions to be set inside the hot chamber shall be as per Para 2.

3.6 Allow the hot chamber to attain temperature of 42±2°C (Test condition 1) / 48±2°C (Test condition 2).

3.7 When above chamber condition is reached doors of the bus shall be kept open. This indicates start of hot soaking of the bus.

3.8 Hot soak the bus for 90 minutes.

3.9 After hot soaking of 90 minutes the driver and two test engineers shall enter the bus and close the doors.

3.10 Initial temperature at nose level of all passenger seat locations shall be recorded before starting engine and AC system.

3.11 Engine shall be started and AC controls are to be set as described in Para 2.5. AC system is switched ON. This indicates start of the test

3.12 Wind simulation fan shall be started.

3.13 Nose level temperature at all passenger seat locations shall be recorded at 1 minute intervals for entire test duration (i.e. 30 minutes for Test condition1 and 40 minutes for test condition 2)

3.14 Air velocity at vents provided above passenger seats shall be measured at the end of the test.

3.15 After the test is complete, the air velocity data recorded and the temperature data recorded shall be presented in a format shown in Annexure B. Extract average passenger nose level temperature and average vent air velocity.

3.16 Average Passenger Nose Level Temperature (in °C) vs. Time (in minutes) graph shall be extracted from the test data.

3.17 From the above graph determine the average passenger nose temperature at 30^{th} minute (Test condition 1) / 40^{th} minute (Test condition 2)

4. 0 Acceptance criteria:

Bus AC system performance shall be considered acceptable if it complies as below:

4.1 **Air velocity:-**

The average air velocity measured at vents provided above passenger seats as described in Para 3.14 should be at least 4.5 m/s.

4.2 **Average passenger nose level temperature:-**

Hot ambient_Test condition 1:

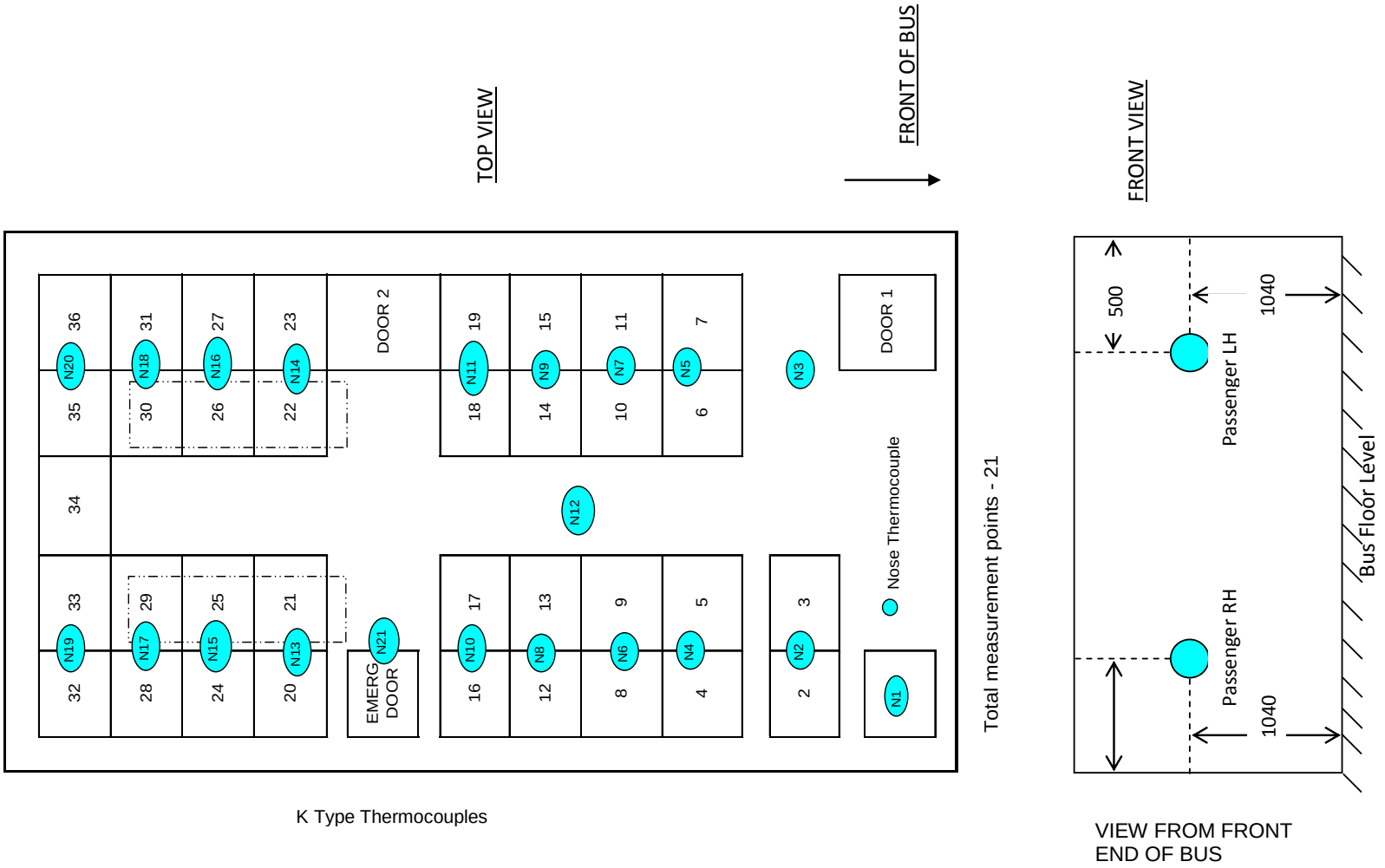
The bus air conditioner should achieve average passenger nose level temperature of 24±4°C in 30 minutes

Very hot ambient_Test condition 2:

The bus air conditioner should achieve average passenger nose level temperature of 33°C in 40 minutes

Annexure A

Instrumentation Inside Bus – Sample Format



Anexure B

AC Performance Test - Sample Format

Ambient Temperature: **Date:**
RH:

Time (min)	Passenger nose level temperature (°C)																					Avg. Temp
	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15	N16	N17	N18	N19	N20	N21	
0.0																						
1.0																						
2.0																						
3.0																						
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29.0																						
30.0																						
																						Avg Vel
Air velocity at vent (m/s)																						

* Continue recording the temperatures till 40th minute for Test Condition 2

Annexure - 5

List of participants of “Urban Bus Committee”

List of participants of "Urban Bus Committee"

S. No.	Urban Bus Committee Member	Designation
1	OSD (UT) & e o. JS, M/O UD	Chairman
2	Representative from D/O Heavy Industries	Member
3	Representative from M/o Road Transport & Highways	Member
4	DG, BPR & D	Member
5	MD, DTC	Member
6	MD, BMTC	Member
7	Director General SIAM	Member
8	President , ASTRU	Member
9	Director, ARAI	Member
10	Director, CIRT	Member
11	Prof H M Shivanand Swamy,Executive Director CEPT	Member
12	DG, IUT	Member
13	Mr. Ajai Mathur, MD, UMTC	Convenor
14	Laghu Parashar, UMTC	Member
15	Manjiri Akalkotkar, CEPT	Member
16	Vivek Ogra, VbSoft	Member
17	Amit Bhatt, Embarq	Member
18	Director, Gets Technology Solutions Pvt. Ltd.	Member
19	Executive Director, Castmaster Group	Member
20	One Representative from Tata Motors Ltd	Member
21	One Representative from Ashok Leyland	Member
22	One Representative from Swaraj Mazda Ltd	Member
23	One Representative from Volvo Buses Ltd	Member
24	One Representative from JCBL Ltd	Member
25	One Representative from Eicher Motors Ltd	Member
26	One Representative from Sutlej Motors Ltd	Member
27	One Representative from Corona Bus Manufacturer Ltd	Member
28	One Representative from Mercedes Benz India Ltd	Member
29	One Representative from Mahindra Navi Star Automotives Ltd.	Member

Ministry of Urban Development
Government of India

www.moud.gov.in
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Recommendatory
Urban Bus Specifications – II