

2015-2036

MMM – City Wide Integrated Public Transport Plan



Annexure U



INTEGRATED
PUBLIC
TRANSPORT
NETWORK

Content

PART C3: TECHNICAL SPECIFICATION	3
C3.1. OPERATING ENVIRONMENT	4
C3.2. SPECIFICATION SUMMARY	4
C3.3. KEY DIMENSIONS OF STATIONS	5
C3.4. DIMENSIONS.....	5
C3.5. GROSS VEHICLE WEIGHT AND AXLES WEIGHT DISTRIBUTION	5
C3.6. LAYOUT.....	5
C3.7. LEVEL BOARDING	5
C3.8. SERVICE ACCESS	6
C3.9. CHASSIS	6
C3.10. BODY	9
C3.11. PROVISIONS FOR PASSENGERS WITH DISABILITIES	13
C3.12. CORROSION PROTECTION	13
C3.13. SPARE PARTS AND MAJOR VEHICLE COMPONENTS	14
C3.14. SERVICE AND TRAINING (ALSO SEE SCOPE OF WORKS FOR DETAILS)	14
C3.15. TESTING AND ACCEPTANCE (TO BE READ IN CONJUNCTION WITH 3.6.2)	14
C3.16. OPERATIONAL LIFE	14
C3.17. WARRANTY.....	15

MMM

APPOINTMENT OF ORIGINAL EQUIPMENT MANUFACTURER FOR THE SUPPLY, MAINTENANCE OF PUBLIC PASSENGER VEHICLES FOR THE MMM PROJECT

PART C3: TECHNICAL SPECIFICATION

Contents

PART C3:	TECHNICAL SPECIFICATION.....	3
C3.1.	OPERATING ENVIRONMENT.....	4
C3.2.	SPECIFICATION SUMMARY	4
C3.3.	KEY DIMENSIONS OF STATIONS.....	5
C3.4.	OPERATING REQUIREMENTS.....	5
C3.5.	DIMENSIONS	5
C3.6.	GROSS VEHICLE WEIGHT AND AXLES WEIGHT DISTRIBUTION.....	5
C3.7.	LAYOUT	5
C3.8.	LEVEL BOARDING.....	5
C3.9.	SERVICE ACCESS	6
C3.10.	CHASSIS	6
C3.11.	BODY.....	9
C3.12.	PROVISIONS FOR PASSENGERS WITH DISABILITIES.....	13
C3.13.	CORROSION PROTECTION.....	13
C3.14.	SPARE PARTS AND MAJOR VEHICLE COMPONENTS.....	14
C3.15.	SERVICE AND TRAINING (ALSO SEE SCOPE OF WORKS FOR DETAILS).....	14
C3.16.	TESTING AND ACCEPTANCE (TO BE READ IN CONJUNCTION WITH 3.6.2)	14
C3.17.	OPERATIONAL LIFE.....	14
C3.18.	WARRANTY	15

C3.1. Operating Environment

The required vehicles will operate in the environment set out in Table C4-1

Table C3-1: Operating Environment

Characteristic	Environment
Region	Mangaung Metropolitan Municipality, South Africa
Terrain	Generally flat, but some rolling terrain and occasional hilly on some routes
Traffic	Mainly urban, sub-urban and rural, with dedicated right of way but some shared right of way some high speed rural
Stop spacing	500m - 1000m on both feeders and trunk routes

C3.2. Specification Summary

The following Specifications Summary sets out the dimensional or other value based specification elements. This summary **DOES NOT** comprise the full Technical Specification and the Tenderer must ensure compliance with all clauses of this Specification Document.

In terms of the above, the vehicles are to satisfy the specified criteria as set out in the following pages which are to be read in conjunction with this specification and National Legislation and Regulation.

Other criteria are given as a nominal value to indicate the expectation of the Purchaser. The Tenderer may deviate from the nominal value subject to achieving related operational and performance criteria. An example of this is the length of vehicles to be supplied. Whilst it is envisaged that a vehicle of a particular overall length be provided, the bus length may deviate from the subject to being able to operate within the prescribed infrastructural environment and satisfy minimum passenger seating and capacity requirements. A second example is the activation time for boarding ramps where significantly deviating from the expected value may impact the number of vehicles required due to cycle time implications and thus render the solution inappropriate.

In all cases, the Purchaser reserves the right to consider a tendered value as being within or not within acceptable limits on the basis of the existing infrastructure and operational plans for the services to be rendered with the required vehicles. Where a tendered “nominal” value is considered out of acceptable limits, the tenderer may be required to demonstrate why the value should be considered allowable.

Table C3-2: Summary of Required Vehicle Specifications

Item			
Chassis Type	Low-entry		
	Nominal	Minimum	Maximum
General Weights and Dimensions			
Vehicle Length	12m	11.5	12.5
Vehicle Width (excluding mirrors)			2.5 m (for GVM < 12tons) 2.6 m (for GVM > 12 tons)
Vehicle height (Road to highest point)			3.5 m
Floor height above road surface during operation	300 mm	280 mm	350 mm
Floor height bottom step above road surface at left side doors	300 mm	280 mm	350 mm
Passenger area ceiling height		2200 mm	
Outer wheel Track radius			11.6 m
Steering Axle Load			7700kg
Rear axle load (single Axle required)			8000kg – single tyres 12000kg – dual tyres
Doors and Ramps	Nominal	Minimum	Maximum
Boarding Ramp length left	350 mm		500 mm
Boarding ramp deployment time	3 seconds		

Boarding ramp slope			1 in 12
Free door width on any passenger door		1100 mm	
Doorway height		2000 mm	
Seating	Nominal	Minimum	Maximum
General Seating configuration	2x2		
Seat Pitch		730 mm	
Seat width		420 mm	
Number of passenger seats, incl. flap down seats	44	40	48
Total Passengers	80	76	
Density	Nominal	Minimum	Maximum
Standing Passenger Density			4.5 passengers per m ²
Number of preferential seats		6	
Length of wheelchair bay		1800 mm	
Flip down seats in wheelchair bay		2	
Power and Performance	Nominal	Minimum	Maximum
Power plant		Diesel	
Power to weight ratio		11 kW / ton GVM	
Performance on gradient with 50 passengers		100km/hr on the level 70km/hr on 2% upgrade 50km/hr on 4% upgrade Able to negotiate a 16% upgrade	
Fuel tank capacity	450 km		
Normal Maximum Operating speed	70 km/hr		70km/hr
Auxiliary Electrical power supply		1KW, 24VDC	
Environmental Standards	Nominal	Minimum	Maximum
Emission Standards		EURO V	
Internal Noise level			80 dBA
External Noise level			83 dBA
External noise level idling			65 dBA
Exhaust outlet location	Left rear with slight deflection to right		
Fleet Management System			
Built-in Tracking System with direct CANBUS interface		FMF Standard 3.0	
General			
Estimated service life		15 years	
Distance from ground surface level to the lower edge of the wing mirror		1800 mm	
Outside edge of wing mirror to the outside ledge of body			250mm
Total height of window unit		980 mm	

Table C3-3: Other Characteristics

Item	Requirement
Vehicles	XYZ
Passenger Doors – Left side	2
Number of Wheel chair bays	1
Body and structure materials	Corrosion and fatigue resistant
Seating material	Hardwearing

Flooring	Hardwearing
Tyre type	Radial Ply
Wheel covers	Optional
Outside edge of left tyre outside edge of right tyre front axle	Suited to duty
Outside tyre edge to outside body edge for front axle (excluding wing mirror) (max)	Suited to duty
Outside edge of left tyre to outside edge of right tyre for rear axle	Suited to duty
Outside tyre edge to outside body edge for rear axle (excluding wing mirror)	Suited to duty

C3.3. Key Dimensions Of Stations

Figure 4.1: Typical Station Cross Section Operating Requirements

- The Buses must meet the following minimum operating requirements:
 - Passenger Combined Seated: 33– 40
 - Standing Capacity: 30 – 45
 - Wheelchair bays: 1x Dedicated Dual Purpose
 - Traffic conditions: Frequent stopping in high density urban and suburban, plus longer distance limited stop services on roads with up to 100 km/h speed limits.
 - Minimum average speed 12-20 km/hour including stops:
 - Daily operating duration: 18 hours per day or up to 450 km per shift. Buses must be capable of achieving this without the need to refuel.
 - Maximum road gradient: 18% (1 in 4)
 - Maximum road cross-fall: Up to 7% (average 2% to 5%).
 - Estimated service life: 15 years.
 - Average annual distance: 60,000 km/year for first ten years, reducing over the remaining fifteen years to give an average of 50,000 km/year.
 - Highest shade temperature: 45 deg C.
 - Lowest temperature: -5 deg C.
 - Built-in Fleet Management System
- Each Bus must be capable of accelerating, when fully laden, in accordance with the following requirements:
 - 0 to 20 km/hour 4.5 seconds
 - 0 to 50 km/hour 17.0 seconds
 - 0 to 60 km/hour 24.0 seconds
- Acceleration and gear changing (both up and down changes) must be smooth enough to prevent annoyance or discomfort to passengers.
- Each fully laden Bus must be capable of stopping, being held on the park brake, and re-starting without rolling back on sealed grades of not less than 18% (1 in 4), both uphill and downhill when fully laden.
- The Buses must meet the performance for operating on gradients as submitted in the specifications.
- The Buses must suffer no structural failures or other problems attributable to the negotiation of roundabouts, speed bumps, slow points and other traffic calming devices encountered in high density urban and suburban areas, plus longer distance limited stop services on roads with up to 100 km/h speed limits.

C3.4. Dimensions

- Each bus must conform to the following requirements, in fully seated form, Requirement Dimension:
 - Maximum length (mm) 12,000
 - Maximum width (mm) excl. mirrors and side lamps 2,500
 - Maximum height (mm) 4,300
 - Wall to wall turning circle diameter (mm) 20,000
 - Minimum approach angle (deg.) fully laden 7.0
 - Minimum departure angle (deg.) fully laden 7.0
 - Maximum height from ground to the top of door steps unladen (mm) 410
 - The floor height at median stations shall be 280(mm) above road level

Front body overhung	Suited to duty
Rear body overhung	Suited to duty
Distance between front and rear axle	Suited to duty
Maximum turning angle, inner wheel	Suited to duty
Maximum turning angle, outer wheel	Suited to duty
Total width of window unit (mm)	Suited to duty
Total effective height of upper sliding vent of window (mm)	Suited to duty

- The bus shall kneel to a floor height of 270 (mm) or less to allow universal access boarding at feeder stops through the deployment of a driver operated or automatic level boarding bridge

C3.5. Gross Vehicle Weight and Axles Weight Distribution

- The front axle shall carry not more than 7,700 kg;
- The driving axle shall carry not more than 12,000 kg (dual tyres)
- All specification shall comply with the National Road Traffic Act Regulations, 1996 (Act 93 of 1996) and all subsequent amendments made to the National Road Traffic Regulations

C3.6. Layout

- All doors, entrances and exits shall comply with the requirements of the relevant regulations of the National Road Traffic Act, 1996 (Act 93 of 1996):
 - Each bus must be right hand drive; 2 doors on the left for curbside boarding at feeder stops;
 - Doors shall be equipped with seals so as not to allow water, dust or air to follow through the forward rear, or top of the door when closed. The edge of the door shall have a rubber strip.
 - Each door shall be fitted with a potential free signal contact to be wired to the on-board ITS system. The signal shall be closed when the door is in the fully open position.
- The left hand doors must
 - A minimum of two door are to be provided on the front left hand side of the bus for curbside operations
 - These doors must have a minimum clear opening of 1100mm between rails
 - The doors are to be a sliding type
 - LHS Door shall have automatic or pneumatically driver operated level boarding bridge system for ease and safety of boarding and alighting of passengers at feeder stops.

C3.7. Level Boarding

- Passenger doors on both sides will be fitted with boarding bridges or ramps. (The terms are used interchangeably and are to be read as including any mechanism or device that achieves desired objective). These ramps shall provide a bridge between the vehicle floor and the station or stop platform. The ramp shall be suitable to accommodate foot and wheelchair traffic with edges tapered adequately to readily allow traversal by the front wheels of a wheelchair. The bridge shall have a safe working load of not less than 300 kilograms.
- Maximum gradient on all level boarding bridges is 1:12 and maximum threshold is 15mm.
- For the left side doors, the use of flap down ramps or bridging mechanism is found desirable. This mechanism is preferred for both sides. Irrespective of the form, ramps shall be retained completely within the main body of the vehicle when not deployed and shall deploy rapidly prior to the opening of the vehicle passenger doors retracting rapidly after door closure. The release and pull as well as the edges of the ramp shall not in any way project above the floor level when the ramp is accessible to passengers.
- The deployment mechanism is to incorporate a failsafe arrangement that ensures that in the event of a person or object being in the path of the ramp during deployment, there will be no force other than natural weight of the ramp applied to whatever is in the way
- The left side ramps shall extend outwards for a length approximately 500mm. The ram length on the left hand side should not exceed 500m but should not be less than 350mm. The width of the ramps shall approximately match the free doorway width (1100mm). The ramps shall be bevelled at the far edge of to facilitate a smooth entry for wheelchairs, prams and bicycles. When deployed, the ramp surface shall have a slip-resistance texture.
- The bottom side of a flip-down type boarding bridge shall be finished to match the colour scheme of the outside of the vehicle body. The boarding bridge shall also be protected at points of contact with the station platform by a rubberised or similar type of material that reduces disfiguration and wear.

C3.8. Service Access

All components of the buses which may require servicing at intervals of 120,000 km or less must be readily accessible without the need to remove fixed panels, frame members or fittings. All service related breakdown items must be located on the near side of the bus body. Typically a left hand side and a rear engine door would be required for exterior access to the engine area. Floor hatches are to be designed in accordance with the Body Builder's Instructions supplied by the chassis manufacturer as a minimum requirement.

All exterior hatches and doors must be made from a durable and lightweight material and be provided with gas struts or similar devices to keep the hatches or doors open and positively closed. Doors that open vertically (i.e. the hinge line is horizontal) must open to at least 150 degrees from the closed vertical position.

All fluids, including lubricating oils and windscreen washer water must be filled or replenished from the exterior of each Bus. It must not be necessary to enter the interior of the bus in order to fill or replenish any fluids, except for the automatic transmission fluid.

With the exception of equipment that must be accessible in an emergency, all hatches and doors to be provided with suitable locking devices.

These are:

- (a) budget locks for exterior hatches and doors;
- (b) quarter turn fasteners for internal floor hatches; and
- (c) key locks for CCTV and drivers lockers

(d) As an option, to prevent passenger access to chassis operating controls, security fasteners may be considered, subject to approval by the Mangaung Metropolitan Municipality. All service access locks to be identical and driver keys must be identical (but different from the service keys). As an option, key locks on exterior hatches may be considered, subject to approval by Mangaung Metropolitan Municipality.

C3.9. Chassis

C3.9.1. General

1. Each Bus must be designed to permit all mechanical and chassis-related maintenance to be carried out from the exterior or from an under floor pit. Buses may not necessarily be maintained with the aid of overhead jacking facilities.
2. Each Bus must be designed for towing.
3. A towing coupling must be fitted at the front end, together with an air coupling to release the spring brakes and charge the Bus's air system.
4. A suitable jacking point must be provided adjacent to each wheel, and each Bus must be designed to permit jacking without causing any structural or other damage.
5. Provision must be made to support each axle of the Bus by means of axle stands when any portion of the Bus is lifted.
6. Each Bus must be geared for maximum economy in normal operation.
7. Each Bus must be speed limited so that it will not exceed 100 km/hour.
8. Protection must be provided at the rear of the Bus for the engine, cooling system and all other mechanical and electrical equipment in order to minimise the effects of any rear end collision or under-run. Such protection must include under body and rear end protection.

C3.9.2. Engine or Motor

1. The Bus shall be powered by diesel and shall be designed to minimise oil changes.

2. Each engine shall, as a minimum, meet the Euro V emissions standards at delivery, with the Bus in full operating condition.
3. The engine shall have at least 6 cylinders and have a turbocharger with intercooler.
4. The engine minimum net power shall be 180kW as per ISO 1585
5. The engine torque shall not be less than 800 Nm as per ISO 1585 (at between 1,200 and 1,600)

C3.9.3. Engine Compartment

1. The design of the engine compartment and the materials used within or near to it must be such that high pressure hot water and steam cleaning equipment using detergents will not cause damage nor affect the operation of the Bus.
2. No flammable material, or material likely to become impregnated with fuel or lubricants, must be used in or near to the engine compartment or within induction or exhaust systems.
3. Accumulation and or retention of fuel, lubricants, vapours or gases in any part of the engine compartment must be prevented by suitable layout of the compartment and the provision of drainage orifices.
4. Insulating materials used in or near to the engine compartment must be suitably protected against accidental damage or wear and tear. In particular, any surface coatings and or coverings must be sufficiently robust so that they will not tear or be damaged easily.
5. The engine compartment must be suitably sealed to prevent ingress of fumes or gases into the passenger compartment.

C3.9.4. Engine Controls and Protection

1. Engine start and stop controls must be provided both in the driver's cab and at the rear of the Bus, adjacent to the engine.
2. Engine start and stop controls must be clearly labelled with the words 'Engine Start' and 'Engine Stop', in English, as appropriate.
3. Each engine stop control must require only a simple action and must be effective immediately.
4. A control must be provided adjacent to the rear engine start and stop controls to enable maintenance staff to isolate the start and stop controls in the driver's cab.
5. Warning lights and/or buzzers must be provided to alert the driver to:
 - (a) low oil pressure
 - (b) high coolant temperature
 - (c) low coolant level
6. A Micro switch, proximity switch, or similar device, must be fitted to the rear engine door, arranged so as to prevent the engine from being started from the driver's cab when the engine door is open. It must still be possible to start the engine from the rear engine controls with the rear engine door open.
7. A fuel gauge must be fitted to the dash panel. The engine management system shall be equipped with a CAN-FMS interface in order to supply data to the ITS system

C3.9.5. Diesel Fuel Storage, Filling and Feed System

1. The minimum fuel tank capacity shall be 350 litres.
2. Each fuel tank must be adequately baffled against surge.
3. The fuel filler must be provided on the nearside or offside of the Bus, below waist rail level and recessed inside the body line.
4. The fuel filler cap must be adequately secured so that it cannot become detached.
5. The filler cap and spout must be arranged so that a straight cylinder of 70mm diameter can be inserted for a distance of 200 mm.
6. The filler cap and spout must be arranged for use with a high-speed refuelling system nozzle which delivers fuel at a minimum rate of 85 litres / minute. At this rate of fill, no "blow back" of fuel must be experienced at any stage.
7. No part of the fuel feed system must be located in the driver's cab or the passenger compartment.

8. All parts of the fuel system must be protected from damage caused by contact with the ground or from flying debris, and from fatigue or wear generated in normal service.
9. Any fuel leaking from the system must be able to flow away freely onto the ground without coming into contact with the exhaust system or any other hot surfaces, or on brakes wheels and tyres.
10. All pipes and connections must be located to facilitate visual inspection, disconnection and re-connection without dismantling any covers, ducts or similar components.
11. All fuel lines must be manufactured from steel or other suitable materials fit for this purpose.
12. A protection plate must be fitted under the fuel tank to prevent damage to the tank underside.

C3.9.6. Cooling System

1. The Manufacturer must ensure that regardless of whether a Bus is stationary or in motion, the cooling system is so rated that the Bus does not overheat when in continuous operation under the operating conditions, with air conditioning on full power and the Bus fully laden to its rated GVM.
2. The cooling system must incorporate a suitable drive system that will require no adjustment between major services.
3. The radiator and fan drive must be located in such a way that they are protected from accident damage in the event of a collision with another Bus, stationary object or moving vehicle.
4. An external gauge or sight glass or similar device must be provide for checking the level of the cooling water without the need to open a door or hatch.
5. Radiator air intake systems must be designed so as to minimise injection and accumulation or blockage by debris and particles normally encountered in operation. Preference is for the radiator to be mounted on the driver's side of the Bus.
6. Radiators and associated cooling equipment must be accessible, in order to provide for external cleaning of both sides of the cores. This must include easy separation of the radiator and any adjacent intercooler or other equipment or structure without the loss of any engine coolant.
7. The radiator must not require cleaning externally more frequently than once every 30,000 kms with all coolant hoses being of the silicon type and pipes to be made of stainless steel or other materials which will not deteriorate.

C3.9.7. Transmission

1. The operation of the transmission must be fully automatic. It must comprise a torque converter in combination with a multi-ratio gearbox.
2. The transmission must incorporate an integral hydraulic retarder. In all cases the operation of the retarder must be controlled by the release of the accelerator pedal or the application of the brake pedal.
3. The transmission selector must be of the push button type located to the right of the steering wheel. Separate buttons for forward movement, Neutral and Reverse movement is required.
4. The transmission selector must be in neutral before the engine can be started.
5. It must not be possible to:
 - (a) Engage reverse gear while the Bus is moving forward; or
 - (b) Engage forward gear while the Bus is moving backwards.
6. The transmission must be controlled in such a way that it suffers no damage if:
 - (a) Reverse gear is selected while the Bus is moving forward; or
 - (b) Forward gear is selected while the Bus is moving backwards.

7. An audible reversing alarm must be fitted, integrated with the on-board management system (where fitted) and arranged to sound whenever reverse gear is selected. An option of a verbal warning system when reverse is selected should be made available. The automatic transmission must be so controlled to prevent engine over revving in the intermediate gears and gear selection is not possible unless the engine is at idle.

C3.9.8. Steering

1. The Bus must be fitted with power-assisted steering which permits manual steering in the event of failure of the power-assistance.
2. The steering wheel must be separately adjustable for height and angle to suit individual driver preference for drivers ranging in size from the 5th percentile female to the 95th percentile male

C3.9.9. Air System

1. The design of the air system must be such that the air compressor is provided only with clean and filtered air.
2. Compressed air from the compressor must pass through an oil and water separating device fitted with automatic drainage before it enters the rest of the system.
3. The front end coupling must be arranged so that, in addition to releasing the spring brakes, it enables the Bus's air system to be fully charged, allowing operation of all pneumatically- operated equipment.

C3.9.10. Braking System

1. The air system must be able to be fully charged from empty within three minutes at an engine speed of 1200 rpm.
2. All wheels must have disc brakes, and all brake pad clearances must automatically adjust.
3. A means of visually determining brake pad wear at each wheel must be provided. It must not be necessary to dismantle or remove any components to ascertain brake pad wear.
4. Under normal operating conditions, there must be minimal brake noise from the discs or pads during service or emergency braking.
5. A means of determining air pressure must be fitted in the driver's instrument panel, showing both brake circuit and brake cylinder pressure separately for each axle.
6. A separate air reservoir must be provided which must be capable of releasing the brakes in the event of a general loss of air pressure.
7. If the passenger door is opened and the Bus is stationary, the rear axle brake must be activated and the engine throttle must be returned to idle and the Bus must be incapable of moving.
8. The application of the rear axle brake to comply with the requirements of clause must produce a nominal retardation rate of 20%g (with a tolerance of +/-5%g) to the Bus.
9. Each Bus must be fitted with electronic Anti-Lock Braking (ABS) on all wheels.
10. All disc pads must provide a minimum services life of 90,000 km when used in normal operations before replacement is necessary.
11. The Bus must have disc brakes on all axles
12. Brake pad wear limit indicators must be fitted.

C3.9.11. Parking and Emergency brakes

1. A fail-safe parking brake must be fitted on each Bus.
2. The parking brake control must be located to the right of the steering wheel and 1 within easy reach of the driver.
3. If the parking brake control is not in the applied position and the 'engine start' key is turned off or the engine has stopped rotating an audible and visual alarm must operate under all conditions. The alarm must continue to sound

until either the ignition is turned on or the parking brake is placed in the applied position. The alarm must continue to sound if the battery master switch is switched off.

4. An audible alarm must be activated whether the engine is running or stopped, whenever the driver's cabin door is open and/or the driver's seat belt is unbuckled and the park brake is not applied. This alarm must be deactivated by the application of the park brake or the cabin door closed or seat belt buckled.
5. To avoid bus runaways, with:
 - (a) a passenger door open;
 - (b) the engine either running, or stopped; and
 - (c) the Bus stationary
6. The rear axle service brake must automatically apply and remain applied until either the accelerator or brake is depressed. A separate driver operated 'Bus Stop' brake must not be fitted.

C3.9.12. Suspension

1. A self-levelling air suspension system must be fitted to each Bus.
2. The suspension system must permit:
3. 'kneeling' at the front doorway;
4. A 'suspension lift' setting to raise the Bus over obstructions.
5. Each Bus must be prevented from moving with the suspension 'kneeling' and must be prevented from 'kneeling' while moving.
6. Each Bus must be restricted to moving at a speed up to 30 km/h with the suspension in the 'lift' condition. If the 'lift' setting is operated while the Bus is moving at a speed greater than 30 km/h, it must not activate or reactivate until the raise switch is operated.
7. The time to lower each Bus from the normal height to the 'kneeling' height must not exceed eight seconds, and the time to raise the Bus from the 'kneeling' height to the normal height must not exceed eight seconds.
8. The time to raise the Bus from the normal height to the 'lift' height must not exceed eight seconds, and the time to lower the Bus from the 'lift' height to the normal height must not exceed eight seconds.
9. Visual warnings must be provided to alert the driver that the Bus' suspension is either in the 'kneeling' or the 'lift' condition.

C3.9.13. Wheels and Tyres

1. All wheels are to be fitted with steel rims.
2. Preferred tyre size is 315/80R 22.5. However, alternatives will be considered.
3. All wheels and tyres must be identical and interchangeable between all wheel positions.

C3.9.14. Instruments and Controls

1. A removable 'engine start' key must be fitted or some manufacturer approved engine start system. All "Engine Start" keys and barrels supplied must be identical, so that any key can start any Bus supplied.
2. Each bus must be incapable of being started and or driven without the use of the 'engine start' key or some other manufacturer approved engine start system.
3. All instruments and controls must be clearly identified by means of pictograms and or signs written in the English language.

4. In the event of only pictograms being supplied for the identification of any warning indicators, a suitable transparent sticker explaining in the English language the meaning of the symbols must be provided and must be fitted to the offside driver's side window.
5. Where an audible warning is provided (e.g. for Bus malfunction, turn indicators, reverse gear, kneeling and lifting, wheelchair ramp operation, etc.) it must be loud enough to attract the driver's attention but not loud enough to cause discomfort or annoyance to passengers and in any event must be less than 85 dbA in cabin area.
 - a. As an option, notwithstanding the bus may be fitted with an electronic odometer, a hub odometer may be considered, subject to approval by purchaser.

C3.9.15. Exhaust System

1. The exhaust system must comprise a stainless steel exhaust pipe from the manifold. Flexible pipe sections must also be used and be made of stainless steel.
2. The exhaust system must be suitably shrouded to prevent accidental contact with hot surfaces in areas where access is required to perform regular servicing and maintenance.
3. The Manufacturer must ensure that engine air intake is complying with the chassis manufacturer's recommendation in relation to the required Euro V emission standard. A water trap must be fitted and positioned so that air cannot be heated by close proximity to the exhaust system.
4. The exhaust outlet must be as near as practical to the rear of the vehicle and discharge rearwards or to the right of the bus either horizontally or no more than 45 degrees downwards and must not extend beyond the perimeter of the bus when viewed in plain view.

C3.9.16. Electrical System

1. Each Bus must be provided with an additional 24 volt DC electrical system, with a separately isolated battery system. This battery system will also charge from the vehicles' alternator. This battery system will be used primarily by the ITS components, and may not drain the vehicles' primary battery system.
2. The battery capacity and alternator output must be sufficient sized that, with the engine running continually at idle speed, the full output of the air conditioning can be achieved and all interior and exterior lights plus ancillary equipment can be on without draining the battery. The ITS battery capacity must be selected in collaboration with the ITS systems installer so an additional dedicated deep cycle battery can be installed by the ITS supplier.
3. Both vehicle and ITS battery banks must be mounted in a swing-out or pull out-crate for access and maintenance. The crate and hatch must lock so as to avoid the crate being left unsecured.
4. A double pole battery isolating switch must be provided adjacent to the batteries to isolate power to the Bus if required.
5. A manually operated battery master switch, which may be combined with the 'engine start' switch, must be provided on the driver's instrument panel.
6. An Oldham Crompton bus booster socket (part number 6.008.25) or similar interchangeable connector must be fitted but for safety reasons, not on the offside of the bus.
7. The main electrical box must be installed inside the Bus.
8. The electrical system must be designed such that sensitive electrical equipment such as radios, destination equipment, interior lighting and ticketing equipment are electrically isolated during engine cranking to avoid voltage spikes. Separate circuit isolators with replaceable fuses shall be installed for each of the different technological components mentioned within the previous ITS components section that will be installed by others.
9. All electrical equipment must conform to the requirements of SANS 1047 - Motor Vehicle Safety Specification and SANS 1017 - Electric Cables For Motor Vehicles.
10. The manufacturer/s shall liaise with and provide suitable mounting locations and, if available, brackets where required.
11. The previous list of ITS components shall be installed.
12. The following signals shall be made available to interface with the ITS system:
 - 12.1. Fuel level, and usage (+-500ml for level, and +-100ml per kilometre);
 - 12.2. Oil level, temperature, and pressure (+-500ml for level, +-1°C for temperature, and +- 10% for pressure);
 - 12.3. Water level, temperature, and pressure (+- 500ml for level, and +-1°C for temperature, and+- 10% for pressure);
 - 12.4. Battery voltage (+- 1V);

- 12.5. Tyre pressure (+-0.25 Bar);
- 12.6. Indicator usage (<250ms trigger as positive input);
- 12.7. Headlight usage (<250ms trigger as positive input);
- 12.8. Brake usage (<250ms trigger as positive input);
- 12.9. Hooter usage (<250ms trigger as positive input);
- 12.10. Emergency signs usage (<250ms trigger as positive input);
- 12.11. Seat belt usage (<250ms trigger of closed contact);
- 12.12. Distance travelled (10% of overall distance);
- 12.13. Acceleration (10% of overall acceleration);
- 12.14. Engine revolutions (5% of rotations per minute);
- 12.15. Vehicle location (within 5m radius);
- 12.16. Vehicle orientation (within 10°); and
- 12.17. Speed (+- 5km/h).
13. The manufacturer shall provide minimum, maximum, and normal operating parameters for the ITS systems supplier.
14. The above signals, where possible, shall be pre-wired to a terminal block to be installed in the ITS compartment.
15. Multiplexing – the bus body and chassis must incorporate a multiplex wiring system. Such a system may control all major chassis and body functions such as lighting, air conditioning, safety systems, door systems, public information systems. The system includes an on board management system with driver graphical interface.
16. The Manufacturer shall work with the chosen supplier(s) of on-bus technology equipment to agree appropriate, secure mounting locations for equipment. The Manufacturer shall ensure that equipment is connected to the electrical system in an appropriate fashion. This equipment shall be installed prior to buses entering service and at a location convenient to all parties involved.
17. The Manufacturer shall work with the chosen supplier(s) to install GPS and communications antennas as required on the bus. It is likely that these antennas will need to be mounted externally.
18. The 12m buses will operate on routes which will have a mixture of open and closed ticketing systems. Therefore, smart card ticket validators will be installed by a third party supplier at the kerb side entrance. The Manufacturer shall propose and coordinate suitable mounting points near each door and ensure that electrical junction points are installed to accommodate the installation of these validators.
19. The Manufacturer shall provide mounting locations for a minimum of three CCTV cameras. The first location will allow CCTV Camera Coverage of the driver and passengers entering by the front door. The second location will allow coverage of passengers entering and exiting by the rear door. The third location will allow CCTV camera coverage of the entire interior of the front of the bus (in front of the articulation joint).
20. The Manufacturer shall provide a suitable mounting location for ITS recording and processing equipment.
21. The Manufacturer shall provide a mounting location for two overhead next stop passenger information displays. The first display location will be visible to all passengers located in the front part of the bus (in front of the articulation joint). The second display location will be visible to all passengers in the rear of the bus (behind the articulation joint)

C3.10. Body

C3.10.1. General

1. Manufacturers should provide state of the art body designs considering aerodynamics, stream lined and incorporating contemporary finishes and latest technological equipment. However designs should not prevent functionality as set out in the scope of works and technical specifications.
2. The Manufacturer must provide evidence that recognised design and evaluation techniques have been used in the design of the body frame. The materials used in the frame such as: 3CR12; 304 stainless steel; galvanised steel or 6000 series aluminium alloy, must be detailed.
3. Two skids must be fitted at the front corners of each Bus, and two skids must be fitted at the rear corners of each Bus. Each skid must be securely attached to the chassis or under-frame of each Bus.

4. Suitable protection must be provided allowing for level boarding via boarding bridge at all stations
5. Suitable precautions must be taken to minimise the effects of any collision on the driver, steering and braking controls.
6. Suitable precautions must be taken to minimise the effects of any collision on passengers, particularly including side impacts in the low floor section.
7. Suitable protection must be provided for the rear end units (engine, transmission, radiator etc.) to minimise damage in the event of a rear end collision.
8. The bodies must be constructed so as to allow, as far as possible for repair and maintenance by using quickly replaced 'off the shelf' parts and sub-assemblies.
9. All internal components and trim with any fixings exposed to the interior of the Bus must be fixed using tamper-proof components which are not readily removable without special tools. Acceptable fixings include such items as Allen head screws, and screws with special head designs. Normal slotted screw fixings are not to be permitted.
10. Interior panels must be durable and lightweight and be bonded or mounted with threaded screws or suitable methods to ensure panels do not work loose or rattle. Self-tapping screws are not acceptable.
11. The Manufacturer must ensure that the top corners of the body cross-section are curved rather than having sharp corners, and otherwise designed so as to minimise the damage caused by collision with overhanging branches, canopies, signs etc.
12. The cant panel areas must be capable of being readily repaired or replaced without disturbing the roof centre or adjoining roof sections.
13. The Bus body should be designed to maximise potential advertising space for the purchaser. Specific areas considered suitable for advertising include the rear panels, side panels below the window line, rear engine door, the cant panel area above the passenger windows, and passenger windows themselves. These areas must be free from any unnecessary indentations and protrusions.
14. The Manufacturer will supply and fit both internal and external decals. The decals must be applied by the Manufacturer in accordance with South African Legislation including the Passenger Transport Act & Regulation and Disability Discrimination Act 1992.
 - a. *As an option, an unobtrusive Rubbish bin inside the bus near the entry door may be considered subject to approval by the purchaser.*

C3.10.2. Exterior

1. The exterior surfaces of each Bus must be free of protrusions likely to cause injury to pedestrians or Bus occupants.
2. The Manufacturer must ensure that fluids will not penetrate the structure or panelling or the interior of the body whether due to weather or operating conditions, the use of bus washes or other cleaning methods, or by any other means.
3. Exterior panels including roof panels must be durable and lightweight either fibreglass, aluminium or other suitable materials and must be fully segregated below floor / seat rail and only partially segregated above floor / seat rail. All exterior panels must be easily replaceable without disturbing any adjacent panels or window(s).
 - a. *As an option, stainless steel side lining trims may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
 - b. *As an option, heavy duty rub rails may be considered, subject to approval by The Mangaung Metropolitan Municipality.*
4. Guttering must not be joined over any doorway.
5. The front and rear corner panels must be made up as sub-assemblies and must be easily replaceable without disturbing any adjacent sections.

6. The front and rear bumpers must be made from a material which is durable and lightweight, in three sections and each section must be easily replaceable without disturbing any adjacent sections.
7. Each Bus must be painted using an appropriate automotive paint process in up to 6 colours to meet the City's required livery (refer to section C3.10). The Manufacturer must ensure that all preparation and painting, is carried out in strict accordance with the manufacturers' written instructions and specifications.
 - a. *As an option, a more sophisticated paint arrangement than that described in the above item may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
8. Where possible the layout of the colour scheme and the provision of joints between parts must permit replaceable panels to be painted in only one colour to assist in the provision of spare parts.
9. On all Buses a stainless steel panel, at least 120 mm in width must be provided below the fuel filler aperture, extending to the bottom edge of the body side panelling.
10. The roof panels shall be designed to prevent water intrusion for the service life of the bus.
11. The bus must be fitted front and rear with heavy duty mud flaps.
 - a. *As an option, rubber wheel arch mouldings may be considered, subject to approval by the purchaser.*
 - b. *As an option, lift-up wheel arch panels may be considered, subject to approval by the purchaser.*
 - c. *As an option, spray arrestors may be considered, subject to approval by the purchaser.*

C3.10.3. Painting

1. The painting of the vehicle shall employ modern best practice and produce a high quality finish. It is preferred that the paint materials and application procedure utilised be as environmentally-friendly as possible.
2. The coatings shall be hard wearing, able to withstand as a minimum 7 years of operation without showing any visible corrosion or degradation, in a high temperature inland environment with high levels of UV exposure, and in operating conditions of a public transport vehicle operating in the conditions set out in the scope of works. Such wear resistance should include the ability to withstand regular machine washing of vehicles. The process and materials used shall be such to allow ready repainting of minor scratches and scrapes.
3. All primers, sealers, paint and any other materials used shall be compatible with assuring chemical bond, adhesion, overall gloss retention, and assuring full warranty by the manufacturer. All paint application shall be in accordance with the specifications of the paints used.
4. The finish coat shall be free of runs, sags, and areas of no gloss. There shall be no bare or exposed metal surfaces showing on the exterior of the vehicles, exclusive of ornamentation, accessories, and bumpers.
5. The underside of the under-frame, flooring and stepwells, wheel-housings and all exposed under-floor surfaces shall be treated with fire-retardant coatings.

C3.10.4. Floor, Steps and Floor Edges

6. The floor must be covered in an appropriate, durable, lightweight flooring material, and all joints must be welded and or fully sealed to prevent water ingress. The front entry area to the point no further forward than the rearmost point in the entry door must be covered in a contrasting colour. A contrasting colour must also be used in the rear door opening area.
7. The disabled access areas must be highlighted by contrasting blue coloured flooring.
8. Each front entry floor area must have one set of 70 mm yellow 'No Standing Area' lettering inlaid. Painted lettering is not permitted.
9. The floor structure and flooring material must be impervious to moisture penetration. The floor structure will be warranted for 10 years and the floor covering (vinyl) will be warranted for 5 years.
10. The floor profile must be designed to eliminate pooling of water when the Bus is parked on a level surface.
11. The floor covering must continue up the sides of the Bus as far as the underside of the body side seat rails.
12. Sharp corners, both horizontal and vertical, must be avoided.

13. All step and platform edges must be fitted with contrasting edging mounted in an aluminium step edge strip.

C3.10.5. Passenger Door

1. Doors will be fitted with locks unless specifically requested to be omitted.
2. The front and rear doors must be two-leaf inward opening, with full depth glazing.

C3.10.6. Glazing

1. All side windows including the emergency exits must be made from toughened grey coloured glass with 48% light transmission, except that the glass covering any external destination indicator or display must be separate from the other windows and must not be tinted.
 - a. *As an option, extra-dark, tinted windows may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
2. Two emergency exit windows must be fitted with fixed grey coloured toughened glass, with 48% light transmission. The rear window shall be the main emergency exit window with the manufacturer to specify the second window location with both emergency windows clearly demarcated as such.
3. All side windows, rear windows and door glass excluding the emergency exit windows, must be fitted with a replaceable internal film. The film must be clear and must be easily replaceable. The film must be designed to protect the window glass from scratching and vandalism, must provide the window glass with additional impact protection and reduce the heat transfer into the driver and passenger compartments. The film must ensure that the glass remains intact in the event of glass breakage, whilst not inhibiting emergency access.
4. Side passenger windows may be bonded, rubbered in or combinations of those systems.
 - a. *As an option, driver lockable hopper windows may be considered, subject to approval by the purchaser.*
5. For bonded passenger windows, the windows must be able to be replaced without the need to reinstate corrosion protective coating on the bus body frame.
6. The minimum number of 'Break Glass' hammers must be provided to comply with standards, together with suitable markings, for use as emergency exits.
7. 'Break Glass' hammers must be retained with high tensile heavy duty wiring and must activate an audible and visible alarm when removed from their mounting. For emergency use, a spare loose hammer is to be provided in the driver's cab.
8. The windscreen preferably is to be a one-piece laminated glass screen, XIR type or equivalent with a heat film. Alternatives of split screen, and rubbered in mounting are acceptable.
9. Where fitted, the rear window must be one piece flat toughened glass.
10. A nearside front corner 'peep screen' must be provided between the windscreen and the front doors, dimensioned so as to provide vision of a one metre high person standing immediately adjacent to the window.
11. Glazed modesty panels must be provided at the rear of the front doorway. They must be arranged so as to prevent passengers from trapping their fingers in the doors.
 - a. *As an option, stainless steel kick panels on the lower section of the modesty panel may be considered subject to approval by the Mangaung Metropolitan Municipality.*
12. The manufacturer shall warrant all glazing and bonding for a minimum period of 5 years.
13. The driver's side window is to comprise twin sliding panels fitted with an impact film or be of laminated glass.
 - a. *As an option, a single sliding and single fixed panel may be considered, subject to approval by the Mangaung Metropolitan Municipality.*

- b. *As an option, a porthole style window may be considered, subject to approval by the Mangaung Metropolitan Municipality.*

C3.10.7. Windscreen Wipers and Washer

1. Large 'fold over' windscreen wipers must be fitted, and they must incorporate variable intermittent, normal and fast speeds.
2. Windscreen washers must be mounted on the windscreen wipers so that they move across the screen with the wipers, with a minimum holding container capacity of five litres.
3. The wiper motor and linkages must be easily accessible for inspection and maintenance.

C3.10.8. Body Insulation

1. The body sides and roof of each Bus must be fitted with suitable thermal insulation.
2. The thermal insulation must be incapable of absorbing moisture.
3. The underside of the floor behind the rear axle must be fitted with suitable heat insulation, noise absorption and noise insulation material.

C3.10.9. Handrails, Stanchions and Bell Pushes

1. The handrails and stanchions must conform to the Universal access requirements. Particular attention is to be paid to ensuring passengers can safely find handrails in the accessible area and in the vicinity of the driver's cabin and door areas.
2. All handrails and stanchions must be manufactured from powder coated stainless steel, with matching clamps and fixings. The hand rails should provide sufficient tonal contrast with the background against which they are viewed. As a safety feature, this degree of contrast should be 70%.
 - a. *As an option, coloured handrails in any suitable material may be considered, subject to approval by the Mangaung Metropolitan Municipality*
3. Longitudinal overhead handrails must be fitted on both sides of the gangway, with moulded individual hanging straps for standing passengers. The hanging straps must be securely fixed longitudinally.
4. Longitudinal handrails must be fitted to the interior body sides between any pairs of facing seats. Handrails are required either side of the doors to assist with boarding and exiting the vehicle
5. Suitable transverse handrails must be provided on each bulkhead or screen ahead of any forward facing seats.
6. Hanging straps must be installed in each Bus in accordance with standing capacity. Seat mounted grips must be aisle side mounted. The hanging straps mounted to the longitudinal hand rails must equate to a minimum of 65% of the total standing capacity.
7. Palm-type bell pushes must be fitted to all stanchions adjacent to seats.
8. Operation of any bell push must activate a bus Stopping Sign, which has an audible and visual warning for the driver, mounted at the front of the Bus, to illuminate until the door is opened.
 - a. *As an option, a second bus Stopping Sign may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
9. A palm type button (with universal Access Markings) within reach of a person in the wheelchair position. This button should activate a slightly different tone, and warning light in the driver's compartment, so the driver is aware that a person in that position potentially needs assistance.
10. The nearside and offside bell push circuits must be completely separated in the event of failure.

C3.10.10. Seats

1. Except for folding seats in the wheelchair area and seats in the rear deck area, seats must be cantilevered from the sides. Floor mounted seats with vertical leg are not permitted in the low floor areas.
2. Seats must be roll top type seats with a vandal-resistant frames and backs. Full size cushions and squabs must be provided and must be easily removable for repair and replacement.
 - a. *As an option, modular seating may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
 - b. *As an option, stainless steel backs for nominated or all rows may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
3. Continuous seat rails must be incorporated in the body sides.
4. A moulded padded grab rail or suitable alternative must be fitted to the top of each seat back (except for the rearmost row of seats).
5. All passenger seats must be trimmed in PVC vinyl or wool over foam upholstery, or acceptable alternative.
6. The driver's seat must be trimmed in wool upholstery, or acceptable alternative.
7. Particular attention must be paid to ensuring high levels of comfort for seated passengers, including seat padding and adequate knee and leg room.
8. All folding seats, when deployed, must meet the same mounting, strength and impact requirements as the fixed seats.
9. All folding seats must be able to be deployed in both the raised and lowered positions, and where possible an armrest must divide each seating position when the seats are deployed in the lowered position.
10. The rear row of seats must be hinged or similar to allow for ready replacement of cushions and seat shells and for cleaning behind the seats.
11. Two front wheel arch rests are to be fitted.

C3.10.11. Rear Vision Mirrors

1. The nearside exterior rear facing mirror must be a heated electrically adjusted convex mirror mounted forward of the entrance doors and visible through the swept area of the windscreen, in accordance with current standard. In the event of an impact, all components must be separately replaceable and the mirror head must be mounted independently from the mounting bracket. Shear bolts are to be used to mount the mirror brackets to minimise damage to the frame in the case of an accident. The lower edge of the mirror must be no less than 2.1 metres from the ground with the Bus standing on level ground and at normal height.
2. The offside exterior rear facing mirror must be a heated electronically-adjusted flat mirror, visible through the driver's side window.
3. External mirrors must be mounted on 'knock-back' arms that will move backwards in the event of impact.
4. External mirror brackets must be mounted onto the body so as to minimise the possibility of the bracket detaching from the body.
5. Interior mirrors must be in accordance with the purchaser's current standards and must comprise a large centre-mounted convex mirror at the top of the windscreen.
6. A convex header mounted mirror must be provided on the near side to provide the driver with a view of the wheel chair area and the area behind the driver's cabin.
7. It must not be necessary to move or adjust any interior mirrors to open any interior service doors or hatches (e.g. for destination or door equipment servicing).
8. All mirror mountings must be designed to minimise vibration to the mirror head.

C3.10.12. Interior Lighting

1. The interior lighting may be fluorescent or LED and covered by diffusers.
2. The layout must include lighting in each body bay, including the rearmost bay. In addition, with the exception of the front doorway, the layout must include an additional light mounted over the doorway (i.e. there must be two lights in each door bay), which must be illuminated whenever the interior lighting is switched on.
3. No more than two screws or other similar fastenings must be needed to be removed to replace a lighting element.
4. A separate driver's cab light must be fitted, illuminating the cab and the cash tray. This light must be activated whenever the front doors are open, and must also be operable at all other times by means of a separate switch. This light must not be fluorescent.
5. A document reading light must be provided in the drivers' cabin area and must be independently switched at all times.
6. Interior lighting must be so designed as to minimise reflections on the front windscreen and side windows adjacent to the driver.
7. Two lights must be provided in the engine compartment.

C3.10.13. Exterior Lighting

1. Exterior lighting at the front must comprise two headlights, two park (or side lights), two front marker lights, two side turn indicators and two School Bus Flashing Lights, in accordance with the Mangaung Metropolitan Municipality requirements.
2. All exterior registration plate, marker, indicator, school, stop and tail lights must be of the LED type.
3. Exterior lighting at the rear must comprise two stop lights, two tail lights, two marker lights, two side turn indicators, two reversing lights and two School Bus Flashing Lights. An additional high mounted stop, tail and side turn light must be fitted at each side of the rear window, wired so as to operate in conjunction with the other rear lights.
4. Exterior lighting and reflectors at the sides must be in accordance with the Mangaung Metropolitan Municipality requirements. Notwithstanding, a side turn and marker light must be located as close as possible to each wheel arch to assist the driver when turning.
5. A fully waterproof external light must be provided adjacent to the entrance doorway, arranged so as to clearly illuminate the lowest door step edge, and also the kerb, pavement or road surface for at least 500 mm beyond the step edge and for at least the full width of the doorway. The light may be LED or other suitable form but must only illuminate when the respective doors are opened and the interior lights are on, and must be extinguished when the respective doors are closed.

C3.10.14. Driver Compartment

The driver's cab must incorporate:

1. A swivel based, spring suspension/air adjustable, driver's seat, including a head rest and adjustable lumbar support, suitable for drivers ranging from the 5th percentile female to the 95th percentile male up to 150kg.
2. As an option, in the above item, mechanical lumbar adjustment may be considered subject to approval by the Mangaung Metropolitan Municipality.
3. As an option, in the above item, a non-swivelling, mechanical suspension, mechanical lumbar adjusting seat may be considered subject to approval by the Mangaung Metropolitan Municipality.
4. An adjustable blind mounted ahead of the driver to cover three quarters of the screen width. An optional electric blind may be considered.
5. An adjustable blind mounted to the right of the driver.

6. A driver's coat hook and broom clip.
7. A personal driver's locker and sufficient lockable space to house service equipment accessible by operational staff.
8. A fire extinguisher to be selected and located in compliance with the Mangaung Metropolitan Municipality standards. The minimum requirement is for a 2A:20B fire extinguisher fitted with a hose, located in a position as to be readily available. As an option, other fire suppression devices may be considered, subject to approval by the Mangaung Metropolitan Municipality.
9. A document holder capable of holding laminated A4 size documents.
10. An inclined foot rest for the driver's left foot incorporating the emergency radio alarm switch and a 2nd switch in a convenient location. As an option, a third switch may be provided, subject to approval by the Mangaung Metropolitan Municipality.
11. As an option, the emergency alarm may incorporate bus horn and headlight flashing functions, subject to approval by the Mangaung Metropolitan Municipality.
12. A cup holder arranged so as to minimise the risk of accidental spillage of any fluids over the driver, passengers or equipment.
13. The dash console must give fingertip control of all switches and controls.
14. The driver's dash is to be designed to be incorporated in a dash riser which has removable panels fitted as required to provide access to components.
15. A driver's cab door must be fitted and must not rattle when closed.

C3.10.15. Heating and Ventilation

1. Each Bus must be fitted with a fully automatic 'heat-cool' air conditioning system. The system must be designed to maximise passenger and driver comfort.
 - a. *As an option, multiple air-conditioning units and compressors may be provided, subject to approval by the Mangaung Metropolitan Municipality.*
 - b. *As an option, alternative low maintenance compressor options may be provided, subject to approval by the Mangaung Metropolitan Municipality.*
 - c. *As an option, supplementary saloon heaters may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
2. When in the cooling mode, the system must be capable of cooling the Bus interior to 22 degrees C under fully laden conditions at all times.
3. The temperature requirements must be capable of subsequent adjustment by the Manufacturer should service experience require it.
4. Relative humidity inside the Bus must normally be around 50% but must not exceed 70% at any time.
5. When in the heating mode, the system must be capable of maintaining an interior temperature of at least 22 degrees C once the engine is warmed up under fully laden conditions at all times when the outside temperature is 2 degrees C or above.
6. The system must incorporate a minimum of 10% fresh air at all times.
7. Driver's controls must be limited to an 'on-off' switch, and temperature adjustment control only, the system must be fully automatic in operation and may incorporate a temperature display adjacent to this switch.
8. The ventilation system must provide an even distribution of controlled air throughout the passenger area and provide the driver with sufficient airflow so as to maintain comfort levels.
9. The controlled air supply to the driver's cabin shall also be provided with a boost fan to allow the driver to control air-conditioned air flow rates independent of the main ventilation fans, if required.

10. A fault light must be incorporated to illuminate whenever there is a fault in the system. A comprehensive warning light panel, which also includes an indication of when the compressor is operating, must be provided in a locked area of the Bus (e.g. inside the recirculating grille), accessible to maintenance staff.
11. The air conditioning system should be integrated with a multiplexed on board computer arranged to allow for subsequent re-programming of operating parameters.
12. As an option, a separate data logger for the air-conditioning may be considered, subject to approval by the Mangaung Metropolitan Municipality. If fitted, the system may record its performance (including, but not limited to, interior and exterior temperatures) and faults over a minimum period of one week, and be capable of downloading this information to a recording device.
13. The ventilation fans must be electronically controlled so as to maintain passenger comfort. In heat mode the fans must only operate when the engine is at operating temperature and sufficient heat is available to heat the passenger compartment if required.
14. In the event of failure of the air conditioning equipment, the ventilation fans must continue to operate to ensure continued ventilation of the interior of the Bus.
15. The system is to incorporate an air distribution system that uses fixed grilles or slots in the passenger area. No air must flow directly onto passengers' heads. Three individual adjustable vents must be provided for the driver, designed so that small objects (rubbish) cannot be pushed into the vents.
 - a. *As an option, variable vents for the air-conditioning in the passenger area may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
16. The system must be designed to provide demisting of the windscreen and all side windows.
17. The system must be inhibited so that, even if the control switch is in the 'on position, the compressor and fans must not start until thirty seconds after the engine is started. This is to avoid the engine being started on load.
18. All air must be filtered, and filters must be easily removable for cleaning.
19. Condensate must not precipitate or collect on any interior surface of the Bus.
20. Roof mounted air conditioning equipment and or pods must be sealed so that no water, from weather conditions, bus washes or any other cause penetrates the interior of the Bus or contracts any structural members or internal panel surfaces or voids.
21. A separate heating, windscreen demisting and driver's ventilation system must be provided at the front of each Bus, using fresh air. To reduce the ingress of traffic fumes, the fresh air must be drawn into the demisting system from the exterior of the bus. This system must also demist the front near side 'peep screen' and the front leaf of the front door and must heat the driver's cabin and driver's feet area. Temperature control must be provided for the driver by means of a rotating switch. (A cable operated 'push-pull' valve is not acceptable). The system must incorporate a two speed fan.
22. The Manufacturer must design the air conditioning system functions to operate in the conditions as outlined in this document.
23. The air conditioning system will not be operational when the alternator is not charging. A warning light will activate when the air conditioning system is not working.

C3.10.16. Roof Hatches and Vents

1. The Buses must be fitted with two manually operated, non-transparent, lift-up roof hatches.
 - a. *As an option, deletion of roof hatches may be considered, subject to approval by the Mangaung Metropolitan Municipality.*
 - b. *As an option, one roof hatch may be considered, subject to approval by the Mangaung Metropolitan Municipality.*

c. *As an option, three roof hatches may be considered, subject to approval the Mangaung Metropolitan Municipality.*

2. The roof hatches where fitted must be capable of use as emergency exits, in accordance with the Mangaung Metropolitan Municipality requirements, and for provision of emergency ventilation.
3. The handles of the roof hatches must be operable by adult passengers in an emergency. Including passengers with disabilities, thus the operating mechanisms must be easy to use, and the hatch must allow a person with a disability to exit through it.
4. The Manufacturer must ensure that each roof hatch and its components is sealed so that no water, from weather conditions, bus washes or any other cause, is able to penetrate the interior of the Bus or contact any structural members or internal panel surfaces or voids.

C3.10.17. Security Video Camera

1. A suitable housing must be mounted for a set of video cameras for on board monitoring as co-ordinated with ITS installers.

C3.11. Provisions For Passengers With Disabilities

1. Each Bus must comply with the Universal Access Accessible Public Transport Disability standards relating to passengers with disabilities.
2. Each bus must have one dedicated dual purpose wheelchair space which are fitted with deployable seats and wheelchair support (ironing board) in order to maximise seating capacity when wheelchairs are not being carried. This space should also allow for the use of bicycles to be carried.
3. Wheelchairs should be able to enter and exit through all doors including the left side front door for feeder stop boarding/alighting.
4. Each Bus must be fitted with an automated level boarding bridge and must be fitted with an electronic voice system which plays pre-recorded messages when the bridges are deployed, instead of using warning buzzers.
5. The automated level boarding bridge must be manufactured from suitable materials so as to minimise weight and maximise durability. The automated level boarding bridge must be designed to ensure easy access and usage for the operator and with minimal operator effort required.
6. Where the automated level boarding bridge is fitted, illuminated amber 'Ramp Out' sign must be mounted over the doorway equipped with a wheelchair ramp. This sign must be illuminated only when the wheelchair ramp is fully extended and the doors are open.
7. The automated level boarding bridge must be interconnected into each Bus' door safety systems. The safety interlocks must be activated when the ramp is in use and the front doors must not be able to be closed with the ramp deployed.
8. The opening and closing of doors should not be allowed to be activated without the deployment of the boarding bridge first.
9. The boarding bridge must be designed to minimise any lip intrusion at either end of the ramp.
10. The required wheelchair space will include an "ironing board" backrest per area.

C3.12. Corrosion Protection

1. Materials used in the construction of each Bus must be suitably protected from structural corrosion so as to allow each Bus to operate for a minimum of 15 years with no repairs to any corroded structural member.
2. Corrosion is defined as the electrolytic and or chemical degradation of any component which affects the structural integrity, safety or the economic Bus life.

3. The vehicle must be designed to prevent electrolytic corrosion between dissimilar metals used in the construction of each Bus so as to allow each Bus to operate for 15 years with no major repairs to any corroded structural member.
4. Suitable drainage and ventilation systems must be provided to prevent accumulation or retention of fluids within the Bus structure or panelling.
5. All closed steel section members, other than stainless steel, must be injected with a suitable corrosion inhibitor. All coatings, corrosion inhibiting compounds, sealants and adhesives must be used in strict accordance with manufacturers' written instructions or specifications. All coatings and associated materials must be of such a generic nature that they do not represent undue risk to operator's health when used in accordance with manufacturer's procedures.
6. The chassis and underside of the body, and all associated equipment, must be designed to resist damage and corrosion caused by the use of high pressure water cleaning and steam equipment, using detergents.
7. The entire chassis, body and associated equipment must be sufficiently corrosion resistant to withstand regular automated washing using recycled washing water.

C3.13. Spare Parts and Major Vehicle Components

1. Chassis and body spare parts must be generally available ex-stock within 24 hours to any site in the purchaser's operating area.
2. The Manufacturer must provide copies of its catalogue of spare parts. The catalogue must include parts description and part number. Any updates to the catalogue must be made available to operators.
3. The tenderer will need to price for the provision of both spare parts and major vehicle components to be delivered and stocked at the purchaser's maintenance facilities after the expiration of warranty and maintenance plans as quoted in the technical schedules.

C3.14. Service And Training (also see scope of works for details)

1. The Manufacturer must provide suitable and sufficient service and repair capabilities within the purchaser's operating area. Such capabilities must be provided for both the chassis and the body and will be available from the date of delivery of the first Bus.
2. During the warranty periods, the Manufacturer must provide sufficient staff and facilities to enable, as a minimum, an inspection of any service problem affecting either the chassis or the body in a timely manner of any service problem becoming apparent.
3. Full service, maintenance and workshop information, and spare parts lists, must be provided by the Manufacturer before the first Bus is delivered (to the operator). All information, manuals and drawings must be written in the English language.
4. The Manufacturer must also provide the bus operator with all OEM documentation, which includes but is not limited to all instructions, manuals, service, maintenance and repair bulletins, information instructions or similar, training materials and other documentation to be prepared by the Manufacturer to enable the operator to operate and maintain the Buses in accordance with the manufacturer's guidelines. These documents must be provided in a manner that is auditable and understood by both the operator and manufacturer.

C3.15. Testing And Acceptance (to be read in conjunction with 3.6.2)

1. The purchaser may test, examine, measure or take such other action as is necessary to determine whether the Bus/es are in accordance with this document and any other mutually agreed documentation considered and agreed as appropriate between the bus operator and the manufacturer, which will include on road performance testing as part of the acceptance process.
2. As a condition precedent to Acceptance for each Bus:

3. A letter outlining the compliance (and non-compliance) to this document must be issued by the Manufacturer.
4. The Manufacturer must provide the purchaser with:
 5. a weighbridge ticket;
 6. a set of signed pre-delivery checklists (covering, as a minimum, the requirements for the chassis, transmission, body, air conditioning and destination equipment as described in the Technical Specification); and
 7. A set of wheel alignment figures for each Bus.
 8. All safety systems for each Bus, including but not limited to the door safety system must be fully commissioned and certified by the Manufacturer as complying with the requirements of the Technical Specification;
9. Each Bus must be fuelled to at least 25% of its full rated capacity.

C3.16. Operational Life

The Manufacturer acknowledges that:

- (a) It will take all reasonable steps in the design of the Buses and their production processes so as to provide a Bus designed to withstand the dynamic and operational loads imposed on it during normal operations for a service life of 15 years commencing from the relevant Date of Acceptance and on the basis that the Buses travel an average of 60,000 kilometres per year for 20 years and provided the Buses are serviced and maintained in accordance with the OEM Documentation;
- (b) Each chassis frame is designed to withstand the dynamic and operational loads imposed on it during normal operations for twenty (20) years commencing from the relevant Date of Acceptance, provided that maintenance has been carried out generally in accordance with the OEM Documentation.
- (c) The destination equipment is designed to remain operational and fit for its intended purpose in accordance with the requirements of the Contract of Sale for a minimum period of ten (10) years for replacement parts from the Date of Acceptance of the relevant Bus;
- (d) The body frame will not fail due to corrosion and will remain operational and fit for its intended purpose in accordance with the requirements of the Contract of Sale for a minimum period of ten (15) years from the Date of Acceptance of the relevant Bus;
- (e) The body frame will not fail due to structural deficiencies or problems and will remain operational and fit for its intended purpose in accordance with the requirements of the Contract of Sale for a minimum period of fifteen (15) years from the Date of Acceptance of the relevant Bus; and
- (e) Spare parts will be available for all Goods for a period of not less than fifteen (15) years from the Date of Acceptance of the last bus to achieve Acceptance. Where advances in technology (particularly regarding, but not limited to, electrical and electronic equipment) make provision of identical spare parts impractical, the Manufacturer guarantees that replacement non-identical spare parts will be interchangeable and will not degrade the performance or life of the Buses.
- (f) Where used in this clause a "failure" means any incident, malfunction, intermittent condition or failure of any component or piece of equipment, in relation to a Bus for which the Manufacturer is responsible, and which requires passengers, or if no passengers are on the Bus, would require passengers to be transferred to another Bus to complete their journeys.
- (h) For the avoidance of doubt, and without limiting the above paragraph, a failure does not include failures in relation to a Bus resulting from deliberate abuse, mishandling, improper storage, accidental damage or failure or malfunction of additional equipment not provided by the Manufacturer such as radio and automatic fare collection equipment (unless caused by the Manufacturer).

C3.17. Warranty

The vehicle warranty (all components) will be as per the manufacturer's standard warranty terms and conditions and as laid out in their warranty manual/policy and as per the requirements indicated in the scope of works.