VERSION BP 4.8

ZERO EMISSION - ONE DOOR URBAN BUS
Bus Specification BP#4 - 15 March 2024

This document is the specification for the variants for ZEB 1 DOOR CITY BUSES. Items shaded grey are not applicable to the specification variant. RESPONSES ARE REQUIRED IN ALL CLEAR CELLS. NO PRICING INFORMATION OF ANY KIND IS TO BE SUPPLIED HERE.

1. DEFINITIONS

1.1	**ADR**	Australian Design Rule applicable to an ME category Heavy Omnibus.
1.2	**A-Pillar**	A structural body frame pillar at the front of a Bus either side of the windscreen.
1.3	**Articulated Bus**	A three axle, Three Door Bus comprising two sections joined by a flexible joint. These buses have Front, Centre and Rear doors.
1.4	**Bus**	Bus meeting the specification set out in this document.
1.5	**Bus Operator (Operator)**	Bus Operator contracted to TfNSW to provide Bus services under a Bus services contract and who is the registered owner of the Bus.
1.6	**Centre Door**	Passenger exit door opening on the left-hand side of the Bus located between the front axle and the rear axle on a 2 axle bus or the centre axle on a 3 axle bus.
1.7	**Certificate of Acceptance**	The written certificate issued under clauses 7.1.6 or 7.1.7(a) of the Deed in respect of a Bus.
1.8	**Compliance Plate**	A plate described in Section 10 of the Motor Vehicle Standards Act 1989. (ADR Definitions and Vehicle Categories)
1.9	**Date of Acceptance**	In respect of each Bus, the date of Acceptance as evidenced in the Certificate of Acceptance for that Bus.

1.10	**DDA**	Disability Discrimination Act 1992 and those Standards supplementing the DDA (standards being the legally binding Regulations set by the Attorney-General under the DDA).
1.11	**Deed**	TfNSW Deed of Standing Offer Bus Procurement Panel 4
1.12	**Diesel**	Automotive diesel as defined by the Australian Fuel Standard(Automotive Diesel) Determination 2001. (Diesel fuel sulfur level is 10 mg/kg)
1.13	**Discharge Capacity**	The maximum capacity in kWh, from a single charge, of a ZEB Battery provided with the relevant ZEB measured at any point in time after the ZEB Battery was manufactured.
1.14	**Double Deck Bus**	A low floor, wheelchair accessible, two door bus, three axle configuration, with an upper deck for seated passengers only and a lower deck for seated and standing passengers, used for passenger services in city and metropolitan areas. These buses have a Front and Centre door.
1.15	**Double Door**	Door opening containing two door leaves.
1.16	**Failure**	Any incidence of malfunction, intermittent condition or Failure of any component or piece of equipment which prevents its safe operation or would result in a defect being issued during a road worthiness check. A Failure does not include Failures resulting from abuse, mishandling, improper storage, accident damage or Failure or malfunction of additional equipment not provided by the Supplier.
1.17	**14.5 m Bus**	A low floor, wheelchair accessible, two door bus, three axle configuration, with a 14.5 long, single deck , used in city and metropolitan areas. These buses have a front and centre door.

1.18	**Front Door**	Passenger entry/exit door opening on the left-hand side of the Bus ahead of the front axle.
1.19	**Fully Laden**	As specified by the manufacturer, but no less than the Bus with driver, full load of seated and standing passengers, all individual options fitted where greater than 2.3kg in mass, all fluids and no less than 75% of Nominal Fuel Tank Capacity of fuel. (Refer ADR Definitions and Vehicle Categories, Maximum Loaded Test Mass)
1.20	**Gross Vehicle Mass**	The maximum laden mass of a motor vehicle as specified by the manufacturer. (ADR Definitions and Vehicle Categories)
1.21	**Ground clearance**	The minimum distance to the ground from the underside of a vehicle excluding its tyres, wheels, wheel hubs, brake backing plates and flexible mudguards and mudflaps. (ADR Definitions and Vehicle Categories)
1.22	**Laden Mass**	The mass of the vehicle and its load borne on the surface on which it is standing or running. (ADR Definitions and Vehicle Categories)
1.23	**Manufacturer**	The name of the person or company who accepts responsibility for the compliance with the Australian Design Rules and to whom the “Compliance Plate’ approval certificate is issued. (ADR Definitions and Vehicle Categories)
1.24	**Nominal Capacity**	The battery capacity in kWh from a single charge of a ZEB Battery to be provided with the applicable ZEB as declared by the Supplier in the Supplier’s RFP Returnable Schedule 3 Response.
1.25	**Nominal Fuel Tank Capacity**	The volume of the fuel tank, specified by the “manufacturer” to the nearest 0.5 litre which may be filled through the (fuel *) tank filler inlet. (ADR Definitions and Vehicle Categories) * fuel in this Specification is Diesel.

1.26	**Occupant capacity**	In determining the occupant capacity of an omnibus, the loading condition shall be that in which a mass of 65kg is located in each of the 'manufacturer's' nominated seating and standing positions for the driver passenger and crew. (ADR 58/00) NB: Personal hand luggage is not included in calculating the occupant capacity.
1.27	**1 Door Urban Bus**	A low floor, wheelchair accessible, NON-seatbelted, one door Bus used for passenger services in regional towns. These buses have a Front Door.
1.28	**Prime**	The prime Bus Supplier as set out in an individual Deed.
1.29	**Rear Door**	Passenger exit door opening on the left-hand side of the Bus behind the rear/centre axle.
1.30	**REESS**	Rechargeable Electrical Energy Storage System. (See ZEB Battery)
1.31	**School Bus Category 4**	A mid floor, one door , seatbelted, two axle configuration, single deck, with passenger capacity greater than 43 seats (excluding driver), used for the
1.32	**Shall**	Indicates a mandatory requirement.
1.33	**Should**	Indicates a recommendation or that which is advised but not mandatory.
1.34	**Single Door**	Passenger door opening with one door leaf.
1.35	**SOH**	State of Health (SOH) means the state of health of a given ZEB Battery corresponding to its Discharge Capacity divided by its Nominal Capacity (expressed as a percentage).
1.36	**Specification**	Detailed specification set out in this document or final approved Bus as agreed by TfNSW.
1.37	**Supplier**	Bus supplier under the Deed also referred to as the prime supplier.
1.38	**TfNSW**	Transport for NSW.

1.39	**Three Door Bus**	Bus with Front, Centre and Rear Doors
1.40	**Two Door Bus**	Bus with Front and Centre doors.
1.41	**Two Door City Bus**	A low floor, wheelchair accessible, two door bus, two axle configuration, single deck, used for passenger services in city and metropolitan areas. These buses have a Front and Centre Door.
1.42	**Unladen Mass**	The mass of the vehicle in running order, unoccupied and unladen with all fluid reservoirs filled to nominal capacity including fuel, and with all standard equipment. (ADR Definitions and Vehicle Categories)
1.43	**ZEB**	Zero Emissions Bus (ZEB) means a Bus which whose primary propulsion and accessory power technologies (including battery electric and/or hydrogen) produce zero carbon emissions in its day-to-day operations.
1.44	**ZEB Battery**	ZEB Battery means a propulsion battery set for a ZEB referred to in Schedules 4 and 8 of the Deed. (See REESS)

2. SUMMARY CONFIGURATION

The following summary provides a summary of the Bus configuration:

2.1	Vehicle and Configuration Details.		
	2.1.1	Chassis Manufacturer	

2.1.2	Chassis Model	
2.1.3	Body Manufacturer	
2.1.4	Body Model	
2.1.5	Air Conditioning OPTION 1 (STANDARD)	
2.1.6	Air Conditioning OPTION 2	
2.1.7	Air Conditioning OPTION 3	
2.1.8	Air Conditioning OPTION 4	
2.1.9	Air Conditioning OPTION 5	
2.1.10	Door OPTION 1 (STANDARD)	
2.1.11	Door OPTION 2	
2.1.12	Door OPTION 3	
2.1.13	CCTV OPTION 1 (STANDARD)	
2.1.14	CCTV OPTION 2	
2.1.15	CCTV OPTION 3	
2.1.16	EBFSS OPTION 1 (STANDARD)	
2.1.17	EBFSS OPTION 2	
2.1.18	EBFSS OPTION 3	

	2.1.19	TPMS OPTION 1 (STANDARD)	
	2.1.20	TPMS OPTION 2	
	2.1.21	TPMS OPTION 3	
	2.1.22	DESTINATION SIGNS OPTION 1 (BASE)	
	2.1.23	DESTINATION SIGNS OPTION 2	
	2.1.24	DESTINATION SIGNS OPTION 3	
	2.1.25	PASSENGER INFORMATION DISPLAY (PID) SYSTEM OPTION 1 (STANDARD)	
	2.1.26	PASSENGER INFORMATION DISPLAY (PID) SYSTEM OPTION 2	
	2.1.27	PASSENGER INFORMATION DISPLAY (PID) SYSTEM OPTION 3	
	2.1.28	SEATS OPTION 1 (BASE)	
	2.1.29	SEATS OPTION 2	
	2.1.30	SEATS OPTION 3	
2.2	Fully compliant to Australian Design Rules for ME category vehicles;		
2.3	Fully compliant to Service NSW Technical Standards (TS);		
2.4	For diesel buses Euro 6 emission minimum, for ZEBs zero emissions;		
2.5	Body length mm;		
2.6	Body width mm;		
2.7	Overall height mm;		

2.8	Wheelbase mm;		
2.9	Rear overhang mm;		
2.10	Right hand drive;		
2.11	Axle configuration:		
	2.11.1	Two-axle, single tyre steer, dual tyre rear;	
	2.11.2	Three-axle, single tyre steer, dual tyre drive, single/dual tag;	
	2.11.3	Three-axle, twin axle steer, dual tyre drive.	
2.12	Unladen Mass kg		
	2.12.1	Front Axle	
	2.12.2	Central / Rear Axle	
2.13	Fully Laden Mass kg		
	2.13.1	Front Axle	
	2.13.2	Central / Rear Axle	
2.14	Vehicle total mass kg		
	2.14.1	Unladen	
	2.14.2	Fully Laden	
2.15	Width Front door mm (left hand side);		
2.16	Width Centre/Rear door mm (left hand side);		
2.17	Bus door safety systems to TS160;		
2.18	Warning signs and lights for school buses to TS150;		

2.19	Destination sign type:		
	2.19.1	Front	
	2.19.2	Side	
	2.19.3	Rear	
2.20	Electric adjustable, heated, exterior, high mounted, rear vision mirrors;		
2.21	standard metro seats - non seatbelted		
2.22	ADR68/00 seatbelted seats		
2.23	Steps at front door entry;		
	2.23.1	Stepless	
	2.23.2	Steps	
2.24	Wheel chair accessible		
2.25	Fuel Type / Energy Type;		
	2.25.1	Diesel	
	2.25.2	Electric	
	2.25.3	Hydrogen	
2.26	Engine/Motor Power kW;		
2.27	Engine/MotorTorque min. Nm;		
2.28	Propulsion Battery type (Lithium Ion for example)		
2.29	ZEB Nominal Capacity for propulsion battery set (kWh);		
2.30	Engine/Motor location;		

	2.30.1	rear	
	2.30.2	mid	
	2.30.3	front	
	2.30.4	wheel hub	
	2.30.5	other (provide detail)	
2.31	Automatic transmission (if fitted)		
2.32	Integral retarder		
2.33	Minimum seated capacity;		
2.34	Minimum standing capacity;		
2.35	Minimum 2 for 3 (2 seats for 3 people) under 12 years old;		
2.36	Bus and configuration is suitable for the following operaing areas:		
	2.36.1	Frequent stopping in high density CBD, inner city and urban areas across Metropolitan and Outer Metropolitan Sydney.	
	2.36.2	Longer distance (up to 50km long routes) limited-stop, route services on city and suburban roads, motorways and toll roads at traffic speeds up to 100km/h.	
	2.36.3	Dedicated school Bus operations which requires frequent stopping in rural and regional areas and longer distance limited stop services on rural roads with up to 100km/hr speed limits.	
2.37	Number of emergency exits in compliance to ADR44/02;		
2.38	Meets Australian Disability Standards for Accessible Pubic Transport (2002) and AS1428.1 and AS1428.2;		
2.39	Meets Bus Materials Fire Performance Requirements in Section 11 of this specification		
2.40	Meets AS5062 for fire mitigation in Bus design;		

2.41	Meets AS5062 and SPCR 183 for Engine/Motor bay fire suppression; and	
2.42	Front, Central and Rear axle tyre pressure monitoring system (TPMS) with over temperature alarm.	

Any proposals for INNOVATION AND SAFETY shall be inserted in the INNOVATION AND SAFETY column(s) in Sections 4 to 62. The INNOVATION AND SAFETY column shall detail the new items proposed.

3. INNOVATION AND SAFETY

3.1	This specification details the standard requirements for the Buses in the Request for Proposals. Within this specification, in accordance with the latest procurement strategy, this specification represents a step change in Innovation and Safety. Specific areas of change include: increased extensive fire mitigation and fire suppression requirements to include smoke and toxicity requirements in accordance with a new standard TS 00013.2:1.0; detailed requirements specifically for electric buses; reporting and data requirments for monitoring and safe operation of electric buses and rigorous engineering management and testing and acceptance requirements to ensure all buses are continued to be built and supported to the highest safety standards.	
3.2	To ensure new safety ideas and improved technology may be considered for this panel contract, TfNSW requests Suppliers actively participate , by providing additional responses to the standard specification.	
3.3	Any such offers shall be inserted in this returnable spreadsheet in the INNOVATION AND SAFETY column(s), separate to the mandatory responses for the standard offer. The INNOVATION AND SAFETY column shall detail the new items proposed.	
3.4	Innovative offers may include, but not be restricted to:	
	3.4.1	Mirrors and camera monitoring;
	3.4.2	New seating configuration to improve passenger seated capacity and reduce passenger falls;
	3.4.3	New seating types and materials for improved comfort and cleanliness;
	3.4.4	Window configuration;

	3.4.5	Regenerative braking or energy storage devices to reduce fuel consumption and greenhouse gases;
	3.4.6	Recycling of materials;
	3.4.7	Fuel efficiency and environmental improvements
	3.4.8	Passenger information systems;
	3.4.9	Destination equipment;
	3.4.10	Accessibility improvements for disabled passengers;
	3.4.11	Fire mitigation improvements;
	3.4.12	Passenger safety improvements;
	3.4.13	Graffiti reduction and reduced maintenance;
	3.4.14	Driver assist features, lane departure, blind spot monitoring and collision avoidance or warning systems.

4. OPERATING ENVIRONMENT	

The Buses will operate in the following environment and the Supplier shall confirm its Buses are designed to operate within each of the parameters set out in this table:			
4.1	General and average traffic conditions for operation:	4.1.1 Frequent stopping in high density CBD, inner city and urban areas across Metropolitan and Outer Metropolitan Sydney.	
		4.1.2 Longer distance (up to 50km long routes) limited-stop, route services on city and suburban roads, motorways and toll roads at traffic speeds up to 100km/h.	
		4.1.3 Dedicated school Bus operations which requires frequent stopping in rural and regional areas and longer distance limited stop services on rural roads with up to 100km/hr speed limits.	
4.2	Minimum average speed including stops:		
	4.2.1	12km/hour in city areas,	
	4.2.2	30km/hr in suburban areas,	
	4.2.3	60km/hr on highways and motorways.	
4.3	Daily operating duration:	18 to 22 hours per day and up to 450km per shift.	
4.4	Fuel / energy need:		
	4.4.1	Minimum 18 hours per day and up to 450km without the need to refuel. (Air conditioning on)	
	4.4.2	Minimum 18 hours per day and up to 300km without the need to recharge/replenish. (Air conditioning on)	
4.5	Maximum road gradient:	18%	
4.6	Typical road cross-fall:	Up to 7% (average 3%)	

4.7	Bus Operating and Service Life:	300 months.	
4.8	Minimum annual operating km	80,000km/year.	
4.9	Maximum summer shade temperature:	48°C.	
4.10	Minimum winter temperature:	-10°C.	
4.11	Outdoor Relative Humidity:	5% to 100%	
4.12	Road surfaces estimated:	Main road: Smooth concrete/ asphalt highway 80% minimum. Secondary road: Rough gravel asphalt 20% maximum.	
4.13	Elevation:	sea level to 2000 metres	
4.14	Physical damage protection	All rooftop systems must be protected from physical damage from weather events (e.g. storms, hail) and objects (e.g. tree branches).	
4.15	Average Operating Conditions:		
	4.15.1	Ambient temperature: 25°C.	
	4.15.2	Peak ambient temperature: 45°C.	
	4.15.3	Typical operating hours: 16 - 20 hours	
	4.15.4	Average passenger load: 50%	
	4.15.5	Average km per day: 300 km/day	
	4.15.6	Average operating speed city areas: 12 km/hr	
	4.15.7	Average operating speed suburban areas: 30 km/hr	
	4.15.8	Average operating speed highways and motorways: 60 km/hr	

5. OPERATING REQUIREMENTS			
The Bus must meet the following minimum operating requirements:			
5.1	Right hand drive		
5.2	The axle configuration required is:		
	5.2.1	Two-axle, single tyre steer, dual tyre rear;	
	5.2.2	Three-axle, single tyre steer, dual tyre drive, single or dual tyre tag (provide details)	
	5.2.3	Three-axle, twin axle steer, dual tyre drive	
5.3	Be capable of accelerating when fully laden with air conditioning compressor engaged in accordance with the following:		
	5.3.1	zero to 20 km/hour 5.0 seconds	
	5.3.2	zero to 50 km/hour 15.0 seconds	
	5.3.3	zero to 60 km/hour 19.0 seconds	
	5.3.4	zero to 80 km/hour 27.0 seconds	
5.4	Supplier to confirm testing at 5.3 is conducted on an asphalt or concrete surface which is level or with a positive gradient. Downhill or negative road gradients are not permitted.		
5.5	Acceleration and gear changing (both up and down changes) must be smooth enough to prevent annoyance or discomfort to passengers.		
5.6	Be capable of stopping, being held on the park brake, and re-starting without rolling back on sealed grades or not less than 18%, both uphill and downhill when fully laden.		
5.7	Be capable of reaching 100km/hr, in top gear, under the conditions described in 5.3 and 5.4.		

5.8	The Bus must not suffer any structural failures or damage to panels and fittings 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 100 km/h speed limits.		
5.9	The Bus must be designed to maximise passenger comfort. Particular attention must be taken to minimise noise, vibration and harshness transmitted to passengers. Factors such as rattles, wind noise, road noise, mechanical noise and air conditioning noise must be minimised.		
5.10	The interior noise levels at the rear five passenger seat must be below 70dB(A) at Engine/Motor idle, and 80 dB(A) at full throttle during a test drive on metropolitan streets using the full range of operating speeds nominated in Section 4. The Leq (1 hour) which is the average noise level on an energy basis (not arithmetic average) for one hour, must not exceed 72dB(A).		
5.11	Suppliers are to ensure harmonics, including those from the driveline, are eliminated by appropriate design.		
5.12	The Bus must be designed to maximise driver comfort in accordance with the passenger requirements of 5.9 and with particular attention to driver's ergonomics, view of mirrors (Refer ADR14/00 Class II mirrors), ventilation airflow and careful location of positioning sunshades to minimise glare in the driver's field of view. Particular attention is required to minimising the gaps between:		
	5.12.1	the windscreen sunshade and the right-hand A-Pillar;	
	5.12.2	the windscreen sunshade and the inner edge of the left-hand rear vision mirror;	
	5.12.3	the right-hand A-Pillar and the inner edge of the right-hand rear vision mirror; and	
	5.12.4	the driver's window sunshade and the outer edge of the right-hand rear vision mirror.	
5.13	Blind spot minimisation is required by minimising the A- Pillar profile from the driver's viewing point while retaining structural integrity as described in 5.8. Refer to ADR 93/00 Forward Field of View and also refer to Rear Vision Mirror Section 28 on locating the exterior right-hand mirror regarding blind spot minimisation.		
5.14	Minimum Passenger Seated Capacity (Passenger Seated Capacity is exclusive of the driver, 65 kg per passenger. (Refer ADR 58/00))		
	5.14.1	66	
	5.14.2	44	

	5.14.3	48	
	5.14.4	44-57	
	5.14.5	57	
	5.14.6	84	
5.15	Minimum Passenger Standing Capacity (Passenger standing capacity is to be calculated based on: 65kg per passenger; and 6.25 passengers maximum per square metre of floor area. Note standing area maximum slope is 8% (4.57º) as per ADR58/00))		
	5.15.1	16	
	5.15.2	20	
	5.15.3	30	
5.16	Minimum 2 seats for 3 people under 12 years old;		
	5.16.1	54	
	5.16.2	78	
5.17	Wheelchair allocated spaces	Two (2) wheel chair allocated spaces with wheel chair access in accordance with the Disability Standards for Accessible Public Transport (2002).	
5.18	Peak Engine/Motor power		
	5.18.1	150kW to 180kW (200hp to 250hp)	
	5.18.2	210kW to 245kW (280hp to 330hp).	
5.19	Engine/Motor torque		
	5.19.1	750Nm minimum @approx 1200 RPM	
	5.19.2	1200Nm minimum @ approx.1200 RPM.	

	5.19.3	1600Nm minimum@ approx 1200 RPM	
5.20	Double deck Bus stability	The stability of the vehicle shall be such that with the upper deck loaded to the most critical conditions of loading and representing a full load of passengers on such deck the vehicle shall be stable when positioned on a flat surface with a 28° transverse slope. (ADR 58/00)	
5.21	Axle Masses. Suppliers shall provide the masses (refer Definitions):		
	5.21.1	Unladen Mass FRONT axle	
	5.21.2	Unladen Mass CENTRAL / REAR axle	
	5.21.3	TOTAL Unladen Mass	
	5.21.4	Fully Laden Mass FRONT axle	
	5.21.5	Fully Laden Mass CENTRAL / REAR axle	
	5.21.6	TOTAL Fully Laden Mass	
6. DIMENSIONS			
The Bus must conform to the following requirements.			
6.1	Maximum length (mm)	ADR 43/04	
	6.1.1	17.5m to 18.0 m body length	
	6.1.2	12.0m to 12.5m body length	
	6.1.3	14.4 to 14.5m body length	

6.2	Maximum width excluding mirrors (mm)	2,500 (ADR 43/04)	
6.3	Maximum height (mm)		
	6.3.1	3.5m	
	6.3.2	3.8m	
	6.3.3	4.3m	
6.4	Maximum wall to wall turning circle diameter (mm)	25,000 ADR 43/04 NB: 24,300 preferred maximum	
6.5	Minimum ground clearance at mid-point between axles (mm)	Wheelbase in metres x 33.33 (may use lifting device to achieve)	
6.6	Minimum ground clearance at any other point on the bus	Vehicle must be able to travel over a peak located between consecutive axles. Peak is formed by two planes tangential to the tyres on those axles. The planes are at 3.82º (1:15) to the horizontal. Refer ADR43/04 Clause 6.4.3 and Fig 1.	
6.7	Maximum rear overhang (mm)	3,700 or 60% of wheelbase ADR 43/04	
6.8	Minimum approach angle fully laden	8.0°	
6.9	Minimum departure angle fully laden	7.4°	
6.10	Minimum departure angle fully laden	8.0°	
6.11	Maximum height (mm) from ground to the top of door step at normal suspension setting.	380	
6.12	Maximum height (mm) from ground to top of door step with suspension kneeling.	320	
6.13	Head room interior single deck and lower deck	The interior height of the saloon in the aisle areas of a single deck Bus or lower deck must be a minimum of 1800mm (Refer ADR 58/00).	

6.14	Head room interior upper deck Double Deck	The interior height of the saloon in the aisle areas of the upper deck on a double deck Bus must be a minimum of 1720mm (this is in excess of minimum required by ADR 58/00).	
6.15	Headroom at rear five passenger seat step	A minimum of 1650mm at the step immediately in front of the rear five seat	
6.16	Minimum vertical distance from a passenger seat cushion to any overhead structure including air conditioning ducts	950mm measured as per ADR58/00.	
6.17	Minimum aisle width for single deck Bus or lower deck	380mm	
6.18	Minimum aisle width for upper deck on double deck bus	300mm	
6.19	Wheelbase mm	Enter wheelbase in mm	
7. QUALITY ASSURANCE			
7.1	The Bus must be constructed in facilities which have appropriate quality assurance systems for design and manufacturing of road vehicles for registration in NSW. The supplier must provide evidence of this system as requested in Section 55. Appropriate systems for example would be those that comply with ISO9001, ISO 55000 and AS ISO 55001.		
7.2	The chassis sub-assembly of the Bus must be constructed in facilities which have appropriate quality assurance systems for design and manufacturing of road vehicles for registration in NSW. The supplier must provide evidence of this system as requested in Section 55. Appropriate systems for example would be those that comply with ISO9001, ISO 55000 and AS ISO 55001.		
8. OPERATIONAL SERVICE LIFE AND WARRANTIES			
The Supplier warrants from the Date of Acceptance for each Bus that:			
8.1	Each Bus (chassis and body) is designed to withstand the dynamic and operational loads imposed on it during normal operations for twenty five (25) years.		
8.2	The body and chassis frames will not be compromised due to corrosion and will remain operational and fit for their intended purpose in accordance with requirements of the Deed for a minimum period of twenty (20) years.		

8.3	The body frame will not fail due to structural deficiencies and will remain operational and fit for its intended purpose in accordance with the requirements of the Deed for a minimum period of twenty (20) years.	
8.4	The panels, floor structure, insulating materials, shields, electrical cable and wiring system will remain operational and fit for their intended purpose in accordance with the requirements of the Deed for a minimum period of twenty (20) years.	
8.5	The Bus is to be warranted for replacement of parts and labour for a minimum of three (3) years for all components excluding: items to be replaced at nominated services; drive belts for fan, alternator and refrigerant compressor or belt adjustments; Engine/Motor tuning; cooling inhibitor maintenance; recharge of air conditioning; re-torquing of bolts; wheel balance and alignment; wheel bearing adjustments; filters; panel adjustments; light globes other than headlamps; fuses; windscreen wiper blades, brake and clutch linings except where specifically warranted, and items damaged by collisions, projectiles, mishandling or abuse.	
8.6	Destination equipment is warranted for ten (10) years.	
8.7	Air conditioning piping, compressor, condenser and evaporator coils are warranted for five (5) years; electronic logic circuits, pressure switches, expansion valves, receiver, valves, thermostats and other control items, condenser fans, evaporator fans, dryer and compressor clutch are warranted for three (3) years; and drive belts are warranted for one (1) year.	
8.8	The floor covering is designed for the operational life of the Bus and is warranted for five (5) years.	
8.9	Spare parts will be available for a period of not less than twenty-five (25) years. Where advances in technology, particularly, but not limited to electrical and electronic equipment, make provision of identical spare parts impractical, the Supplier guarantees that replacement non-identical spare parts will be interchangeable and will not degrade the performance or life of the Buses.	
8.10	Systems shall only require upgrades to accommodate new requirement requests from TfNSW.	
8.11	Replacement components shall be usable with no functional modifications required to other elements of the bus. The components shall reflect what is the best replacement available, where possible serving better than the original operationally: in installation, location, maintenance, and service life.	
8.12	All disc pads will provide a minimum service life of 50,000km when used in normal operation before replacement is required.	

8.11	Decals must be fit for their intended purpose, be designed for a minimum of seven (7) years for internally fitted decals and a minimum of five (5) years for externally fitted decals. Warranty is for three (3) years including but not limited to:		
	8.11.1	Peeling	
	8.11.2	Cracking	
	8.11.3	Fading	
	8.11.4	Loss of resistance to strong cleaning chemicals such as graffiti removers.	
8.12	Rain or wash water will not penetrate the structure, panelling or the interior of the Bus for a minimum period of twenty (20) years.		
8.13	Reporting for ZEB Battery Warranty Monitoring:		
	8.13.1	As part of the Supplier's response to this RFP, the Supplier will provide the ZEB Battery SOH degradation profiles for the ZEB Battery over a minimum of 8 years from the Date of Acceptance of a ZEB for the range of acceptable charging and bus operational duty cycles it nominates, noting the operating requirements nominated in Sections 4 and 5 of this Specification.	
	8.13.2	The Supplier will report on the SOH ZEB Battery capacity for each ZEB to the Principal and the relevant Bus Operator at the Date of Acceptance using the SOH monitoring process and report format agreed in writing by the Principal, the relevant Bus Operator and the Supplier.	
	8.13.3	The Principal, the relevant Bus Operator and the Supplier will use reasonable endeavours to agree the SOH ZEB Battery monitoring process and reporting format at 8.13.2 by no later than at the Date of Acceptance for the relevant ZEB.	
	8.13.4	The Supplier will undertake the SOH ZEB Battery monitoring process and provide the Date of Acceptance SOH ZEB Battery report in the agreed format to the Principal and the relevant Bus Operator no later than 20 Business Days after the Date of Acceptance for the relevant ZEB.	

	8.13.5	The Supplier must formally report on the annual SOH ZEB Battery capacity for each ZEB to the Principal and the relevant Bus Operator every 12 months from the Date of Acceptance by the Operator using the SOH monitoring process agreed to at 8.13.2.	
	8.13.6	The Supplier must provide the annual SOH ZEB Battery report to to the Principal and the relevant Bus Operator no later than 20 Business Days after the anniversary date of the Date of Acceptance for the relevant ZEB.	
	8.13.7	The Principal and the relevant Bus Operator will review the Date of Acceptance SOH and annual SOH ZEB Battery capacity reports at 8.13.4 and 8.13.5 respectively and compare them with the profiles provided by the Supplier at 8.13.1.	
	8.13.8	The review at 8.13.7 will occur within 20 Business Days of the Customer receiving the respective SOH report from the Supplier.	
8.14	Additional Warranties For ZEBS:		
	8.14.1	The Date of Acceptance SOH for the ZEB Battery for a ZEB will not be less than 1% of the Nominal Capacity provided at 8.13.1.	
	8.14.2	ZEB Battery warranty period is a minimum period of 8 years operation under normal operating conditions from the Date of Acceptance of a ZEB.	
	8.14.3	During the ZEB Battery warranty period specified in 8.14.2, the annual SOH of the relevant ZEB Battery will not degrade by an amount greater than 3.5% in comparison with the annual SOH for the immediately preceding year. If it degrades by greater than 3.5%, the Supplier must repair or replace that ZEB Battery so that the annual SOH degradation of that ZEB Battery is no greater than the annual SOH ZEB Battery degradation in the relevant profile provided by the Supplier at 8.13.1.	

	8.14.4	During the ZEB Battery warranty period specified in 8.14.2, the SOH of the relevant ZEB Battery will not degrade by an amount greater than 20% in comparison with the Date of Acceptance SOH. If it degrades by greater than 20%, the Supplier must repair or replace that ZEB Battery so that the SOH degradation of that ZEB Battery is no greater than the SOH degradation in the relevant SOH ZEB Battery profile provided by the Supplier at 8.13.1.	
	8.14.5	The electric motor propulsion system will have an operational life of 20 years with standard, specified maintenance provided by or on behalf of the Principal or the relevant Bus Operator.	
9. VEHICLE COMPLIANCE AND PRECEDENCE			
9.1	Where a conflict exists between any part of this Specification and the requirements of Clauses 9.2 and 9.3, Clauses 9.2 and 9.3 take precedence.		
9.2	At the Date of Acceptance, each Bus must comply with all relevant Australian Design Rules (ADRs) and National Heavy Vehicle Regulations, as well as all instructions, notices and regulations issued by Transport for NSW (TfNSW) and the Service NSW; including Technical Specifications (TS) published by Service NSW.		
9.3	Each Bus must comply with all relevant Australian and International Standards Codes including lawful directions of all competent authorities. including compliance with Federal Government vehicle recall process, relating to or otherwise affecting the subject matter of the Contract.		
9.4	Each Bus must meet the relevant exhaust emissions regulations in effect at date of registration to the TfNSW contracted Bus operator. Currently ADR80/03 requires Euro 5 standard emissions, however TfNSW recognises manufacturers have been producing Euro 6 engines and this cleaner technology is the required standard.		
9.5	The Bus must be registrable in NSW by Service NSW at time of entering the Deed and throughout the term of the Deed.		
10. ACCESSIBLE PUBLIC TRANSPORT REQUIREMENTS			
10.1	Each Bus must comply with the Disability Standards for Accessible Public Transport 2002.		

10.2	Each Bus must have access for wheelchairs and conveyances through the Front Door and have a level floor within 1:30 (0.12 degrees) in the wheelchair spaces.	
10.3	The exterior of the front door must have two vertical strips, in colour specified in Section 14, 25mm wide, to delineate the door aperture in accordance with AS1428.1. These vertical strips may be positioned internally on the door glass as per the diagram in Appendix 10.	
10.4	Each Bus must have two (2) wheelchair allocated spaces.	
10.5	Wheel chair allocated spaces are a minimum size of 1300mm long by 800mm wide and clear for a minimum height of 1500mm above the space as per AS 1428.2.	
10.6	The allocated space must have a border 25mm wide (within the allocated space dimension) with colour as per Section 15 and the allocated space within the boundary being coloured as per Section 15.	
10.7	For aesthetic purposes, the border is preferrred to have a nominal 25mm internal radius at the corners.	
10.8	The international accessibility symbol, as defined in AS 1428.1, height of symbol to be approximately 300mm, in colour specified in Section 15, is to be located centrally in the allocated space and must indicate the correct orientation of the wheelchair against its passive restraint (the occupant facing the rear of the bus).	
10.9	The border and accessibility symbol must not be thin surface coatings, rather they are to be a significant thickness of the floor covering, suitably sealed to prevent liquid leakage to the underlying floor material.	
10.10	A wheelchair ramp Bus stop request button is to be clearly marked with an international accessibility symbol, in the wheelchair allocated space. The button must be positioned on the Bus side wall in an area 700mm to 1300mm from the Bus floor and 700mm to 900mm rearward of the padding on the passive restraint. The Reach requirement (common zone) was determined from AS1428.2, Clause 22.	
10.11	The Bus stop push button surface in the wheelchair allocated space must be a minimum of 25mm in radius or width, and flush to its housing so as not be susceptible to accidental activation. Refer AS1428.2	
10.12	The audible tone of the wheelchair Bus stop push button must be readily different to the standard Bus stop push button.	
10.13	Additional Bus stop push buttons are required in the wheelchair accessible area for passengers not requiring the wheelchair ramp to be deployed by the driver.	
10.14	The design of any luggage rack, modesty screen or fitting must not intrude on circulation spaces to access the allocated spaces for wheelchairs.	

10.15	A grab handle compliant with AS1428.1 must be provided in the wheel chair area sidewall located in the vicinity of the stop push button to allow comfortable access for wheelchair users.	
10.16	The grab handles must not create a shoulder or head strike hazard for passengers sitting in the fold down seats in the wheelchair allocated space.	
10.17	Each Bus must have a manually operated wheelchair ramp located at the Front Door, to be operated by the driver.	
10.18	Wheel chair ramp is to be compliant with the relevant requirements of AS 3856.1 and AS 3856.2 for Type E Appliances to be manufactured from materials which minimise weight and maximise durability.	
10.19	The wheel chair ramp must be designed to ensure easy usage by the Bus driver with minimal effort to deploy and retrieve (100N maximum force as per AS 3856.2).	
10.20	A hooked rod or other device to lift the ramp is to be provided and be able to be stored in the driver's area in a location not able to be reached by passengers and the rod must not to rattle in its holder.	
10.21	The wheel chair ramp must interface with the Bus door safety system such that the Front Door cannot be closed with the ramp in the deployed position.	
10.22	Any area to be accessed by a wheelchair, including the wheel chair ramp, shall have a minimum safe working load rating of 300kg. Refer AS 3856.2.	
10.23	In each wheelchair area, to restrict movement of a wheel chair or conveyance in the forward direction, a passive restraint in the form of a padded vertical board is required, where the padding complies with TS148.	
10.24	To restrict sideways movement, the passive restraint is to be fitted with a a tether strap which comprises an inertia locking retractor and buckle complying with ADR4/05. The buckle and retractor are co-located to allow the webbing to be looped around a suitable part of the wheelchair or conveyance.	
10.25	Each Bus must be fitted with a hearing augmentation system (loop) in accordance with AS 1428.2 that provides 100% coverage of the total area of the internal passenger space of the Bus.	
10.26	Automatic "stand clear doors closing" audible warning tone shall sound when the Centre /Rear Door is closing.	
10.27	A decal of size 110mm x 100mm, in accordance with AS1428.2, indicating the Bus is equipped with hearing augmentation is to be fitted to the entry door as per the relevant TfNSW decal manual.	
10.28	Not used	
10.29	To accommodate passengers with visual impairment, the destination signage as set out in Section 35 must be white on black LED type indicators, fitted to the front, left hand side and rear as appropriate.	

10.30	All step and platform edges must be fitted an aluminium edging with size and contrast in accordance with AS 1428.2. Figs. 8 & 9. A slip resistant strip insert on the horizontal face is to be coloured as per Section 15.		
10.31	Step riser height: ADR 58/00 specifies a maximum internal step height of 300mm, but for this Bus specification, a maximum of 250mm riser height is specified to improve safety. (For reference, AS 1428.2 specifies a riser of 165mm maximum, but gives precedence to ADR58/00.)		
10.32	Step tread depth: ADR 58/00 specifies a minimum internal step tread dimension of only 225mm, but for this Bus specification, a minimum of 250mm plus a 25mm undercut, giving 275mm in total tread depth is specified to improve safety. (For reference, AS 1428.2 specifies a tread depth of 275mm minimum, but gives precedence to ADR58/00)		
10.33	Steps in any consecutive sequence must have an even riser height within 5mm.		
10.34	Handrails and grab handles must comply with the requirements of AS 1428.2. The colour specified in Section 15.		
10.35	Handrails and grabrails must be located to allow passengers to always have at least one hand hold to move around the Bus with particular attention to:		
	10.35.1	the area between the Front Door and the wheel chair allocated areas	
	10.35.2	the access paths from the Front Door to the top of the upper deck staircase	
	10.35.3	the access path from the top of the staircase to the Centre Door	
	10.35.4	preventing seated passengers and passengers manoevering on the upper deck while the Bus is in service, from falling into the open space above the staircase.	
10.36	Where steps are relieved with a cut-out, to allow the swing in of a glide away door for example, a heavy duty kick panel in stainless steel sheet with a suitable frame is to be provided to prevent a passenger's foot from slipping into the cut- out or accidentally stepping into that area.		
11. FIRE MITIGATION DESIGN AND MATERIALS			

11.1	The Supplier shall ensure that the Bus is designed, constructed and commissioned such that it satisfies the Fire Risk Management and Fire Risk Reduction requirements of AS 5062-2016, and the Supplier shall also consider the information contained in the Bus Industry Confederation (BIC) Fire Mitigation Advisory, published in 2014.		
11.2	During the Contract period a new fire standard may come into effect and Suppliers are advised that revised offers may be requested to accommodate this standard.		
11.3	Not used		
11.4	To limit the risk of occupant injury due to fire the following standards shall apply:		`
	11.4.1	To limit ignition and **flame spread** in materials, BS476 Part 7 shall apply to the various areas of the bus nominated below in accordance with the Class specified (Class 1, 2 or 3), or where an area is not specified shall comply with ECE Regulation 118 Annexes 6, 7 and 8 .	
	11.4.2	As an alternatative to 11.4.1, European Standard EN45545-2 /HL2 (Hazard level 2) which requires test method ISO 5658-2 for **flame spread**, shall be applied to the areas nominated below. In some parts of the bus, such as the roof and the floor, ISO 9239-1 will apply in lieu of ISO 5658-2. (Note that in EN45545-2, material requirement sets range from R1 through to R26. Specific parts of the vehicle are required to comply with a specific requirement set, for example, roof panels have a requirement set R8.)	
11.5	All exterior fibreglass materials shall comply with BS476 Part 7 Class 2 or EN45545-2 R7/HL2 - ISO 5658-2;		
11.6	All exterior roof materials shall comply with BS476 Part 7 Class 2 or EN45545-2 R8/HL2 - ISO 5658-2;		
11.7	Front exterior fibreglass panel materials comply with BS476 Part 7 Class 3 or EN45545-2 R7/HL2 - ISO 5658-2;		
11.8	Internal panels and laminate materials shall comply with BS476 Part 7 Class 2 or or EN45545-2 R1/HL2 - ISO 5658-2;		

11.9	Floor covering materials shall comply with BS476 Part 7 Class 2 or EN45545-2 R10/HL2 - ISO 5658-2;	
11.10	Floor structural material shall comply with BS476 Part 7 Class 2 or EN45545-2 R10/HL2 - ISO 5658-2;	
11.11	Seat frames ABS or polycarbonate material comply with UL94, V0;	
11.12	Seat fabric/foam shall comply with BS5852 Crib 7, no flaming allowed to continue after 13 minutes from start of test;	
11.13	Body insulation materials shall comply with BS476 Part 7 Class 2 or EN45545-2 R1/HL2 - ISO 5658-2;	
11.14	All internal air conditioning ducts, ABS products, cappings and finishing items shall comply with UL94, V0 or EN45545-2 R1/HL2 - ISO 5658-2;	
11.15	Internal light diffusers shall comply with BS476 Part 7 Class 2 and UL94, V0 or EN45545-2 R4/HL2 - ISO 5658-2 and UL94, V;	
11.16	All electrical wiring shall be resistant to flame propagation in accordance with ISO 6722-2006 or EN45545-2 R15 and R16 /HL2 ISO 60332-1-2, and 60332-3-24 or EN 50305.	
11.17	All internal components in the Bus not specified above, which are identified as a fire risk under AS5062 , shall meet the specifications of ECE Regulation 118 or the flame spread requirement for the relevant material requirement set specified in EN45545-2/HL2 -ISO 5658-2 .	
11.18	Each Bus must have a firewall between the Engine/Motor bay and passenger compartment that in the event of a fire in the Engine/Motor bay would prevent the fire from entering the passenger compartment for 15 minutes to enable all passengers to evacuate the Bus. The firewall is to be compliant with the E15 requirements of EN45545-3	
11.19	For double deck buses the air conditioning compartment above the Engine/Motor must also have a firewall to prevent fire entering the passenger space for 15 minutes as per 11.18.	
11.20	All materials forming the fire wall between the Engine/Motor area and the passenger area must comply with BS476 Part 7 Class 1, ECE Regulation 118, or EN45545-2 R7/HL2 - ISO 5658-2.	
11.21	Particular attention shall be paid to ensuring that all penetrations and voids are protected with appropriate fire rated materials to achieve the fire barrier requirement.	

11.22	Where hoses and cables penetrate a fire wall, appropriate fire protection wrapping or sleeving is required to ensure a fire path is not created through the firewall.	
11.23	Any sealants or adhesives used in the firewalls must have a minimum 4 hour fire rating.	
11.24	No insulating material likely to become impregnated with fuel, lubricant or other combustible substances shall be used in the Engine/Motor/Drive compartment. Non-absorbency to be in accordance with Annex 9 of EN118. The insulating material is to be covered by an impermeable non-flammable sheet.	
11.25	Precautions shall be taken, either by a suitable layout of the Engine/Motor compartment or by the provision of drainage orifices, to avoid as far as possible, the accumulation of fuel, coolant, lubricating oil or any other combustible material in any part of the Engine/Motor compartment. (Refer ADR58/00)	
11.26	Heat shields made from non-flammable materials with melting temperatures in excess of 1200 C (such as steel) shall be fitted between heat sources such as exhaust systems, catalytic converters, retarders, heaters (other than those supplied by hot water) and the other Bus components and equipment to prevent heat damage and possible fire if those components become defective such as alternators.	
11.27	Heat sources at item 11.26 are also to be adequately ventilated to dissipate heat outside the bus. Particular attention is required to adequately provide space between flooring, hatches and side walls. Temperature measurements are to be taken to ensure the surrounding materials are within their maximum heat ratings.	
11.28	Drip shields are to be fitted to prevent fuel, coolant, lubricating oil or any other combustible fluids leaking onto hot items or items that may fail and become hot, such as alternators, where those temperatures exceed the ignition temperature of the fluids.	
11.29	Each Bus shall have a means to stop the supply of fuel/energy to the Engine/Motor bay without damaging the Bus. If this system is manually activated it must be able to be activated from the driver's cabin.	
11.30	A 4.5kg (agent capacity) ABE fire extinguisher with a fire rating of 4A:80B:E (22 secs discharge, approximate dimensions: height 470mm, width 216mm, depth 148mm) shall be provided in a housing located near the driver's cab. Alternatively, to address individual driver weight handling requirements, two fire extinguisher with a minimum capacity of 1.5kg (agent capacity) ABE fire extinguishers may be provided., the first extinguisher located near the driver, the second extinguisher shall not be accessed on the exterior right-hand side of the bus (traffic hazard). It is acknowledged these requirements exceed the minimum requirements of AS 2444.	

11.31	Two fire extinguisher with a minimum capacity of 1.5kg (agent capacity) ABE fire extinguishers may be provided., the first extinguisher located near the driver, the second extinguisher shall not be accessed on the exterior right-hand side of the bus (traffic hazard). It is acknowledged these requirements exceed the minimum requirements of AS 2444.		
11.32	For double deck buses the upper deck will be supplied with an additional fire extinguisher as per 11.30 in a break glass enclosure with the extinguisher alarmed as per the emergency hammers.		
11.33	For ZEBs, the drive battery compartments must be provided with firewalls as per 11.18.		
11.34	Floor hatches must be sufficiently sealed to prevent smoke ingress, noise insulated and no less flammable than the surrounding floor.		
11.35	The service schedules for the complete Bus must include specific instructions on checks to reduce fire hazards. Such checks must address all areas known as causes of fires, and all areas of fire risk.		
11.36	All wheelarches are to be designed to prevent wheel fires entering the the passenger space as per 11.19.		
11.37	In each deck of the bus , in the rear 1/3 of the body, at least one concealed smoke detector fitted with an audible warning device must be located in the ceiling. In addition, an audible and visual warning must be incorporated in the driver's dashboard.		
11.38	The smoke detector and alarm must comply to AS3786		
11.39	For ZEBs,		
	11.39.1	Bus Battery compartment locations are to be marked clearly on the external part of the bus and provided with ports to provide access for firefighting.	
	11.39.2	For REESS containing flammable electrolyte, a fire resistance test in accordance with ECE Regulation 100, clause 6.5 is required.	
	11.39.3	Supplier shall demonstrate and explain a thermal management system that will respond to a potential fire threat. It should prevent the temperature of any cell from exceeding an OEM prescribed safe limit, for longevity and to prevent thermal runaway.	

12. ENGINE BAY / MOTOR / ENERGY FIRE SUPPRESSION SYSTEM (EBFSS)			
12.1	Each Bus must have an automatic Fire Suppression System that:		
	12.1.1	Meets the P-Mark certification standard SPCR 183;	
	12.1.2	Satisfies the requirements of AS 5062:2016;	
	12.1.3	Is not a hazard to any person;	
	12.1.4	Is suitable for installation on vehicles used for mass transit services;	
	12.1.5	Is able to protect the Engine/Motor/Energy , transmission and surrounding areas taking into account known heat sources including, but not limited to, the alternator, turbocharger, fuel lines, catalytic converter and major electrical connection points;	
	12.1.6	Is designed to prevent a fire progressing to the Bus body and passenger compartment;	
	12.1.7	Is designed to function effectively whilst the Bus is in motion, stopped with the Engine/Motor running or stopped without the Engine/Motor running;	
	12.1.8	Includes a system fault function test for technicians;	
	12.1.9	Provides the driver with an audible and visual notification on Bus start-up that the system is operative;	
	12.1.10	Takes account of likely flame front direction or fire paths and all recognized possible sources of fire;	
	12.1.11	Includes components, such as mountings and connections that are fitted in accordance with any relevant requirements of the vehicle supplier so as not to void any chassis or body warranties. No chemicals or other materials used shall void the chassis or body warranties; and	
	12.1.12	includes an effective notification system that provides the driver with a clear and distinguishable audible and visible alarm to the driver when the fire suppression system has been activated; and	
	12.1.13	is discrete enough so as not to panic passengers on the Bus.	

	12.1.14	Takes into account the passenger unloading time for the configuration of Bus (low floor, mid floor, double deck)	
12.2	Power for the System control panel must be provided from at least two separate power supplies, as follows:		
	12.2.1	The primary power supply shall be of sufficient capacity to independently provide power for all System functions when the equipment is running;	
	12.2.2	The secondary power supply shall be capable of supplying sufficient power to operate all System functions; and	
	12.2.3	The secondary power supply shall be supervised and generate a fault condition when it's no longer able to meet the requirement in point (i) above.	
13. TYRE PRESSURE MONITORING SYSTEM (TPMS)			
13.1	The TPMS must be fully automatic and inclusive of all hardware and fittings for a complete installation. The TPMS must be robust and of good quality and provide for continues monitoring of tyre pressure and warns of Front, Central and Rear tyre over temperature. The TPMS must be able to provide:		
	13.1.1	A dash mounted graphical user interface that indicates the system is active and which provides functions including visible and audible warnings with overrides;	
	13.1.2	User defined minimum and maximum tyre air pressure and exceeding 80°C temperature with audible and visible alerts to the driver when minimum and maximum pressure settings have been reached and when the 80°C temperature has been exceeded;	
	13.1.3	Constant monitoring of tyre air pressure, with pressure measurements provided in PSI, KPA and BAR and temperature measurements provided in Celsius Capable of monitoring 4 to 20 tyres;	
	13.1.4	Monitoring of sensors to alert a problem or malfunction on the driver display screen;	
	13.1.5	Owner TPMS manuals;	
	13.1.6	System dedicated power supply;	
	13.1.7	Detection Ease of maintenance and repair when necessary;	

	13.1.8	Reliable performance and not be affected by road vibration;	
	13.1.9	Wireless monitoring sensors;	
	13.1.10	All mounting brackets, power cable, clamps and necessary works including all necessary fittings and fixings and consumables items to secure equipment to various makes and models of Bus;	
	13.1.11	All required labelling, and operating signage.	
13.2	The System must be designed to be fail-safe. Regardless of what is occurring on the Bus, the System must operate when activated and be so designed that it does not create potential safety issues.		
14. BUS LIVERY - EXTERNAL			
14.1	The Bus must comply with the information set out in document: BC/14-23562 (2018) SMBSC and OSMBSC Transport for NSW Bus Livery or any later revision released by TfNSW. Refer Appendix 1. For Cat4 and One Door Urban buses only, please refer to Regional Bus Livery Guide - Bus Type:Cat 4 School Bus and One Door Urban Bus in Appendix 13. Note the options for alternative liveries in the Options section at 61.37 and 61.38.		
14.2	A general arrangement drawing is required for TfNSW approval. (Refer Section 55).		
14.3	TfNSW Bus Livery Colour Scheme, PPG Reference Colour Codes:		
	14.3.1	297C Blue Delfleet	
	14.3.2	10MA White Delfleet	
	14.3.3	KT79 Black Delfleet	
	14.3.4	ALL 417 LINE.	
14.4	Contrasting vertical strips at front door to be YELLOW.		
14.5	Housing of left hand rear vision mirror is to be YELLOW.		
14.6	Any Bus body design change during the term of the Deed must be reflected in the general arrangement drawing provided at Section 55 and submitted to TfNSW.		

15. BUS COLOUR SCHEME – INTERNAL		
15.1	Standard seat colour BLUE moquette pattern as per TfNSW current approved standard in APPENDIX 11.	
15.2	Priority Seating and seating in the wheel chair area to be moquette material colour RED as per TfNSW current approved standard in APPENDIX 11 .	
15.3	Interior floor colour MID to DARK GREY similar to Gerflor TaraBus Sirius 6727 Anthracite NT, Altro Meta Storm TFM22903 or Altro Meta Genome TFM2202.	
15.4	Floor colour in non-standing areas to be RED similar to Gerflor TaraBus Sirius 6132 Rubis NT or ALTRO META SAFETY RED TFM22261	
15.5	Lettering in non-standing areas to be YELLOW with words NO STANDING AREA	
15.6	Wall colour is LIGHT GREY or similar.	
15.7	Wheel chair space border colour is WHITE	
15.8	Wheelchair allocated space is LIGHT GREY similar to Gerflor TaraBus Sirius NT: 6768 Griffon or ALTRO META PEWTER GREY TFM2289	
15.9	International Accessibility Logo (proportions in AS1428.1) in allocated space is WHITE.	
15.10	Rear vision mirror casing on left-hand side to be INDUSTRIAL YELLOW.	
15.11	Step edging and plinth edging inserts to be coloured INDUSTRIAL YELLOW.	
15.12	Window cappings to be DARK GREY or similar.	
15.13	Air–conditioning ducts to be MID GREY or similar colour to hide hand marks and stains.	
15.14	Centre ceiling panel to be WHITE or similar light colour.	
15.15	Horizontal handrails STAINLESS STEEL.	
15.16	Vertical handrails to be STAINLESS STEEL.	

15.17	Grab handles to be INDUSTRIAL YELLOW (If powder coated, to be in accordance with AS 4506:2005).	
15.18	Door handrails INDUSTRIAL YELLOW (If powder coated, to be in accordance with AS 4506:2005).	
15.19	Bus stop push button casings YELLOW.	
16. INTERIOR DECALS AND EXTERNAL LOGOS		
16.1	Interior Decals and Exterior Logos must be applied to comply with the document in Appendix 2	
16.2	All Decals shall be manufactured in accordance with AS 4833-2007 (Pressure sensitive labels for stock-paper, stock-plastic and general purpose use).	
16.3	Retro reflective decals shall have a reflective property in accordance with AS/NZS 1906.2:2007 (Retro-reflective Materials and Devices for Road Traffic Control).	
16.4	Luminous or self-illuminating decals to be in accordance with ADR44/02, which requires the decal to be luminous for at least 15 minutes after the vehicle ceases operation or 15 minutes after loss of battery power.	
16.5	Decals to be supplied in Calendar Vinyl minimum thickness 110 microns (including adhesive).	
16.6	Decals shall be covered with a graffiti resistant over laminate to be applied as a clear gloss film. Spray type laminates are not preferred.	
16.7	The laminate shall have an adhesive that will bond permanently to the decal, be clear in colour and shall not discolour the printed decal.	
16.8	Decals shall have an adhesive quality such that the Decals cannot be easily removed.	
16.9	The graffiti resistant laminate must be the exact size of and fully cover the printed decal.	
16.10	The laminate must be resistant to all cleaning chemicals and be able to withstand repeated cleaning using commercially available solvents or paint remover without leaving residual staining or discolouring the decal surface.	
16.11	Suppliers must provide drawings, confirming compliance with the above document, for approval by TfNSW prior to construction of the first bus. Refer Section 55.	

17. SERVICE ACCESS			
17.1	All components of the Buses which may require servicing at regular intervals must be readily accessible without the need to remove fixed panels, frame members or fittings.		
17.2	For driver and road maintenance team safety, all road service related breakdown items must be located on the front, rear or left-hand side of the Bus body only.		
17.3	Typically for workshop maintenance, in addition to the access doors at 17.2, right hand side door(s) would be required for exterior access to the Engine/Motor area.		
17.4	Floor hatches are to be designed in accordance with the Body Builder's Instructions supplied by the chassis manufacturer as a minimum requirement. (Also refer to Section 11 for Fire Mitigation).		
17.5	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 when shut. Doors that open vertically (i.e. the hinge line is horizontal) must open to at least 150 degrees from the closed vertical position and the hinge be located on the upper edge.		
17.6	All fluids, including lubricating oils and windscreen washer water must be able to be filled from the exterior of the Bus. It must not be necessary to enter the interior of the Bus in order to fill any fluids, except for the automatic transmission fluid.		
17.7	A small access hatch must be provided to allow quick access to the transmission oil dipstick.		
17.8	Easy access for safely checking and filling hydraulic oils		
17.9	Easy access for safely checking and filling engine oil.		
17.10	Easy access for safely checking and filling Engine/Motor or other coolants		
17.11	Any exterior ventilation panels on the Bus below the cant rail must have a mesh/hole size of less than 5mm to prevent finger entrapment by children or adults, who may be standing outside the Bus or provide hand-holds for bicyclists. Holes in panels with tapered shapes are not permitted.		
17.12	With the exception of equipment that must be accessible in an emergency, all hatches and doors must be provided with suitable locking devices such as:		
	17.12.1	Key locks for CCTV and drivers lockers.	

	17.12.2	Quarter turn locks with 7mm square locking pegs for hatches and doors.	
	17.12.3	If quarter turn locks are used there must only be one locked and one unlocked position and there must be a visual indication of the locked/unlocked position.	
17.13	All service access locks must be identical and driver keys must be identical (but different from the service keys).		
17.14	Service access to critical areas where relavant such as the rear of the alternator, turbo charger, batteries, brakes, transmission and other critical items shall be provided to facilitate maintenance of these items.		
18. BODY – GENERAL			
18.1	The body frame material preference is for non-corrosive metals such as stainless steel or aluminium alloy.		
18.2	Coated or galvanised steel frames may be considered subject to demonstrating a high level of corrosion protection.		
18.3	Suitable structure must be provided to protect the ramp and passenger door area from impact damage.		
18.4	Suitable precautions must be taken to minimise the effects of any collision on the driver's cab area, battery compartment, steering and braking controls.		
18.5	Suitable precautions must be taken to minimise the effects of any collision on passengers, particularly side impacts in the low floor section.		
18.6	Suitable protection must be provided at the rear of the Bus (Engine/Motor/Energy/Power Cables, and radiator) to minimise damage in the event of a rear end or side collision. Particular attention is to be paid to protect from oil leaks, battery packs, electrical shorting and damage to drive belt pulleys.		
18.7	The bodies must be constructed so as to allow, as far as possible for ease of repair and maintenance, quickly replaceable parts and sub-assemblies.		
18.8	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 or Phillips head screw fixings are not acceptable.		
18.9	Interior panels must 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.		

18.10	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 and signs.	
18.11	The cant panel areas must be capable of being readily repaired or replaced without disturbing the roof centre or adjoining roof sections.	
18.12	The Bus body shall 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 equipment access door, the cant panel area above the passenger windows, and passenger windows. These areas shall be free from any unnecessary indentations and protrusions.	
18.13	The bus body must be designed to allow the repeat application and removal of bonded advertising without specialised techniques, significant effort, or damaging the Bus body.	
18.14	The exterior surfaces of each Bus must be free of protrusions or features likely to cause injury to people brushing against the bus. Refer ADR42/05 and ADR92/00.	
18.15	Exterior panels, including roof panels, must be durable and lightweight. Panels must be fully segregated below floor / seat rail and may be partially segregated above floor / seat rail.	
18.16	Exterior panels must be readily repairable in the event of minor damage.	
18.17	All exterior panels must be easily replaceable without disturbing any adjacent panels or window(s).	
18.18	All exterior panels must be fitted or bonded to the Bus body in a manner which prevents water being trapped behind the panel creating a corrosion risk.	
18.19	Guttering must not be joined over any doorway.	
18.20	The front and rear corner panels must be made up as sub-assemblies and must be easily replaceable without disturbing any adjacent sections.	
18.21	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 adjacent sections.	
18.22	Each Bus must be painted using an appropriate automotive paint process. The Bus manufacturer must ensure that all preparation and painting, is carried out in strict accordance with the paint suppliers written instructions and specifications.	
18.23	The Bus must be fitted with heavy duty, rear mud flaps.	
18.24	The Supplier must detail the materials, such as: C3R12 stainless steel; 304 stainless steel; galvanised steel or 6000 series aluminium alloy, that are used in the Bus frame, chassis extension, wheel arches, steps and floor support framework.	

18.25	The methods used for frame joints must be described with reference to quality assurance processes used to demonstrate compliance. (welded or bolted)		
18.26	Where there is potential for dissimilar metals in the frame and/or chassis to come into contact, appropriate measures must be taken to prevent galvanic corrosion.		
18.27	Heavy-duty skids must be fitted at the front corners, and rear corners of each Bus. Each skid must be securely attached to the chassis or under-frame of each bus. Each skid must be installed such that it protects the body in the event of ground strike.		
18.28	The floor of any upper deck on a double deck Bus shall be constructed and drained to prevent water from entering any lower deck		
18.29	Emergency exits are to be provided in accordance with ADR44/02.		
	18.29.1	Minimum number of emergency exits on single or lower deck shall be 6.	
	18.29.2	Minimum number of emergency exits on upper deck shall be 6. NB: access between decks may be considered an emergency exit for each deck.	
	18.29.3	In the case of a double deck vehicle there shall be an emergency exit in either the front face or rear face of each deck. (ADR44/02). In this Bus specification an emergency exit on the lower deck shall be through the front windscreen.	
	18.29.4	Each emergency exit, including the windscreen if used as an emergency exit, shall be capable of operation from both inside and outside the vehicle .(ADR44/02)	
	18.29.5	Emergency exit windows, including the windscreen if used as an emergency exit, shall be easily operated by one adult and take no longer than 30 seconds to open/break.	
	18.29.6	External operation of a break glass emergency exit may be conducted by using a heavy item such as a rock . Typically the external emergency sign will depict a rock.	

	18.29.7	Suppliers are to note the internal and external emergency exit signage requirements in ADR44/02, including the self illuminating, retroreflective size and positioning requirements.	
	18.29.8	'Break Glass' hammers at emergency window exits must be retained with high tensile heavy-duty wire and must activate an audible and visible alarm when removed from their mounting.	
	18.29.9	For emergency exit windows, a decal with contrasting letters no less than 20mm high must be located below the EMERGENCY EXIT sign with the words "DO NOT FIT IMPACT FILM"	
18.30	For buses which may require vehicle frontal protection systems (VFPS) such as bull bars, refer Options Section 62		
19. ELECTRONIC TICKETING: TfNSW – ETS / OPAL			
The supplier must prepare each Bus ready for wiring for Electronic Ticketing Equipment (ETS) in accordance with document referenced in Appendix 4. The Opal specifications include details of:			
19.1	Driver console mount positioned so the ticket machine does not interfere with driver forward vision and ensure compliance with ADR 42/05 and ADR 93/00 regarding compliance with field of view.		
19.2	Driver console mount to support the Opal driver console.		
19.3	Driver console and mount to ensure Bus operator's driver cash box can be used.		
19.4	Suitable cable concealment tray incorporated or securely fixed to Driver console mount to support cables to the driver's console.		
19.5	Opal reader mounted on the Bus dash board area.		
19.6	Suitable locations to support additional opal readers at the Front and Centre/Rear doors.		
19.7	Power to ETS Bus tap off terminal strip or plug mounted in the allocated space inclusive of 24v/0V DC constant supply. Cable needs to be suitable to carry a maximum 15 amps.		

19.8	Ignition DC constant 24v DC. Cable needs to be suitable to carry maximum 5 amps.	
19.9	Reverse signal 24 V DC signal for when Bus is in reverse and 0 V signal for when Bus is not in reverse.	
19.10	The Bus Chassis Manufacturer to ensure the odometer signal used by the AVL meet the industry standard C3 Pulse width modulation. Odometer signal specified is 5.0v DC minimum high and 0.6v DC maximum low.	
19.11	Cable pathways to support the wiring of Opal at a later stage to all devices inclusive of conduit and draw wires down stanchions and through A/C ducts where access is limited.	
19.12	Suitable location on the Bus roof of a metal sheet under the fibreglass, with a supporting bracket located to mount the Tri band Antenna.	
19.13	Suitable infrastructure to support a second Opal reader at the front door ensuring DDA, ADR and Opal ergonomic and installation guidelines are maintained.	
19.14	Suitable infrastructure to support two Opal readers at any other door ensuring DDA, ADR and Opal ergonomic and installation guidelines are maintained.	
19.15	An equipment storage space is required within the Bus to mount the supporting infrastructure to support ETS devices. This space must be secure and away from passengers. Refer to Appendix 4 for equipment space details.	
19.16	The space referred to in 19.15 requires easy access, for maintenance, via a hinged door with industry standard locks.	
19.17	This space may be integrated with the housing for the passenger information display, with the equipment for the PID being located in space additional to that reserved for the ETS.	
20. PASSENGER DOORS		
20.1	Passenger doors must fully comply with ADR58/00, the Service NSW Technical Specification 160 and Service NSW Technical Specification 147 and any relevant Technical Specification updated during the term of the Deed.	
20.2	For the Bus door safety system defined by Service NSW technical specification TS160, the pre-set speed for the safety system is 5km/hr;	
20.3	When the door brake is activated the retardation is to be in the range 0.15g and 0.25g; and	
20.4	The gradient to be used for the TS160 retardation test is 12º or 18% gradient.	
20.5	The Front Door must be an inward glide Double Door opening, with full depth glazing.	
20.6	The Front Door must be an inward glide Single Door opening, with full depth glazing.	

20.7	The front door function is for wheel chair and ambulant entry/exit.		
20.8	Front door minimum clear width minimum		
	20.8.1	850mm (minimum)	
	20.8.2	920mm (minimum)	
20.9	The Centre/Rear Door must be an inward glide Double Door opening.		
20.10	The Centre/Rear door function is for ambulant exit.		
20.11	Centre/Rear door minimum clear width 920mm.		
20.12	Passenger doors must be close fitting in their apertures to reduce wind noise and dirt and moisture ingress.		
20.13	Passenger doors must be:		
	20.13.1	designed for high frequency duty cycles;	
	20.13.2	have highly reliable entrapment sensors in accordance with TS160, and not be affected by rain, leaves discarded rubbish, pressure waves from passing trucks or any other effects experienced in a busy operating passenger transport environment;	
	20.13.3	constructed from robust and reliable components; and	
	20.13.4	precision designed to require minimal adjustment	
20.14	Passenger doors must be designed not to burst open if a person falls heavily against the doors.		
20.15	Designed using long life components.		
20.16	The Front, Centre Door and Rear Doors shall not be fitted with locks as standard, but locks may be provided as an option for specific Bus operators. Refer Section 61.		

20.17	The driver door controls must be on the right hand side of the driver to reduce unauthorised access		
20.18	The door control is to be spring-loaded toggle switch with fore and aft action, or push buttons (open and close), depending on Operator preference.		
20.19	Status indicators (LEDs) are required near the door control buttons / switches to indicate if the door system has:		
	20.19.1	a fault (red LED),	
	20.19.2	is OK (green LED)	
	20.19.3	or is in override condition (amber LED).	
	20.19.4	each light is to be appropriately labelled.	
20.20	Emergency Door Release (EDR) Buttons must be provided for each door internally and externally in accordance with information at Appendix 5.		
20.21	Each EDR button will be covered by a top-hinged flap to prevent inadvertent activation.		
20.22	The interior EDR buttons must be marked in letters at least 10mm high, in a colour which contrasts with the background on ‘self- illuminating material” (ADR 44/02)		
20.23	The exterior EDR buttons must be marked in letters at least 10mm high, in a colour which contrasts with the background on ‘retroreflective material” (ADR 44/02)		
20.24	The internal EDR buttons at the front, centre/rear doors are to be red.		
20.25	The front door external EDR button is to be red and located in the same housing a door close button which is green (The green button must not close door unless hand brake applied).		
20.26	The Centre/Rear door external EDR button is to be red.		
20.27	A door override switch is required for each door, appropriately labelled, located inside the front door header box.		
20.28	When the front door over ride switch is activated the door safety system (reopening and accelerator interlock) will be deactivated and the door will open. The door can then be operated using the door control buttons.		
20.29	When the centre/rear door over ride switch is activated the door safety system will be deactivated and the door will close. The door will also be isolated and cannot be opened or closed using the driver door control buttons.		

20.30	No door override switch can be activated if the handbrake is not applied.	
20.31	The handrails on the doors are to be designed to allow a 5 percentile female passenger standing on ground level to comfortably reach the hand rail before stepping on to the bus, and that the hand rail sweep upward to allow that passenger a comfortable hand hold once boarded.	
20.32	The handrails on the doors are to coloured as per Section 15.	
21. GLAZING		
21.1	All glazing must comply with ADR8/01. Glazing includes all body glass, windscreen and any other transparent panels in the Bus. Internal panels such as modesty panels and driver's protection screens may be made of plastic materials and must comply with Appendices 14 and 15 in ADR8/01.	
21.2	All glass must carry the indelible marking or marks of the relevant standards and be visible when the glass is fitted to the vehicle in accordance with clause 7.4 in ADR8/01.	
21.3	Any bonded glass must be able to be replaced without damaging any corrosion protection coatings on the Bus body frame.	
21.4	For safe operations, the glazing and dashboard must be designed to allow the driver to sight a one metre high object, positioned outside the bus, immediately adjacent to the left hand A- Pillar.	
21.5	The windscreen must be laminated glass with a visible light transmission (VLT) of at least 75% (VSI 3 rev 3) and no tinting in the field of view as per ADR8/01.	
21.6	Windscreens are to be one piece. (Refer Section 61 Options for two-piece windscreens).	
21.7	Windscreens may be directly bonded or extrusion mounted. (Refer Section 61 Options for rubber mounted).	
21.8	Windscreen heat filtering film such as XIR type must be configured to ensure that toll tags function effectively.	
21.9	Side windows must be made from tempered glass, tinted grey with a maximum 35% light transmission. This means the side windows are tinted, but darker tinting is acceptable. Refer to 21.11 and 21.12 for specific requirements for driver's window and front door glass.	
21.10	Side windows must be directly bonded. (Refer Section 61 Options for rubber mounted).	
21.11	The driver's window must:	

	21.11.1	comprise twin sliding panels	
	21.11.2	be limited to opening 100mm maximum	
	21.11.3	have tempered glass	
	21.11.4	For safety, have a visible light transmission of at least 35% . (NSW Vehicle Information Standards VSI 3 Rev 3) This means the driver's window glass may be clear (VLT approximately 75%) or tinted to a have a visible light transmission (VLT) of no less than 35%.	
	21.11.5	be fitted with a transparent guard panel (such as tempered glass) to prevent a person standing outside the driver's window from reaching the door close controls.	
21.12	For safety, the front door glass must have at least 35% visible light transmission. (NSW Vehicle Information Standards VSI 3 Rev 3) This means the front door glass may be clear (VLT approximately 75%) or tinted to a have a visible light transmission (VLT) of no less than 35%.		
21.13	Glazing covering external destination signs must be separate from other windows and untinted with at least 75% light transmission.		
21.14	A rear window glass is not mandatory as the bus is fitted with exterior mirrors and consideration shall be made to provide a fire barrier.		
21.15	Full height modesty panels comprising glazing from least above waist rail level, must be provided at the rear of the Front Door and the front and rear of the Centre Door. They must be located so as to prevent passengers from trapping their hands when a door opens, and any integrated handrail or grab rail must comply with AS1428.2.		
21.16	Side windows, rear windows (if fitted) and door glass, but excluding any break glass emergency exit windows, are to be fitted with an impact resistant, anti-graffiti, replaceable protective film. The impact protection provided is to be in compliance with Section 5 in AS1288.		
21.17	The protective film must be clear, easily replaced, designed to protect the window glass from scratching and vandalism, provide additional impact protection as per 21.16 and reduce heat transfer into the bus.		
21.18	For the driver’s window the impact film combined with the glass must prevent at least 98% of UV(A) passing into the bus.		
22. WINDSCREEN WIPER AND WASHERS			

22.1	Large ‘fold over’ windscreen wipers must be fitted, and they must incorporate variable intermittent, normal and fast speeds. Refer ADR42/05.	
22.2	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. Refer ADR42/05.	
22.3	The wiper motor and linkages must be easily accessible for inspection and maintenance.	
22.4	Wipers must operate smoothly without juddering or bounce at the various design speeds of the Bus and for sub-tropical heavy rain events expected in the operating area.	
22.5	Wipers are to minimise, as much as possible, unswept areas adjacent to the A-pillars to minimise blind spots.	
23. BODY INSULATION		
23.1	The body sides and roof of each Bus must be fitted with suitable thermal insulation. Refer Section 11 Fire Mitigation.	
23.2	The thermal insulation must be not be capable of absorbing moisture and fuel oil. Refer Section 11 Fire Mitigation.	
23.3	The underside of the floor behind the rear axle must be fitted with suitable heat insulation, noise absorption and noise insulation material. Refer Section 11 Fire Mitigation.	
23.4	The insulation must be capable of suppressing noise levels as specified at Section 5.	
24. HANDRAILS AND GRAB RAILS		
24.1	Handrails and grab rails must conform to the Disability Standards for Accessible Public Transport (2002) and the associated Australian Standards AS 1428.1 and 1428.2.	
24.2	For hygiene and cleanliness, handrails and grab rails are not to have finely textured surfaces which trap dirt and grease. Open textures may be permitted if easy to clean.	
24.3	The fastenings, materials and construction of the handrails and grab rails are to comply with the load requirements of AS1428.1	
24.4	Particular attention must be paid to the positioning handrails and grab rails in the wheelchair accessible area and in the vicinity of the driver’s cabin and front and centre door areas to provide support for passengers boarding and alighting the bus, and for support while the Bus is in motion.	

24.5	All vertical handrails to be as per Section 15 with matching clamps and fixings.	
24.6	Longitudinal, overhead handrails, finished as per Section 15, must be fitted on both sides of the aisle in the low floor section of the bus. These handrails must be fitted with individual hanging grab handles coloured as per Section 15 for standing passengers.	
24.7	On any pair of facing seats, grab handles of colour specified in Section 15, complying with AS1428.1, must be fitted to the interior body sides approximately midway between the seats. The aisle edge of the pair of facing seat frames must also be provided with grab handles complying with AS1428.1, coloured as per Section 15.	
24.8	On any transverse seat where the aisle or stepped aisle is more than 100mm lower than the level of the floor at the passenger's feet, the aisle-side edge of the seat frame must be provided with a grab handle coloured as per Section 15, complying with AS1428.1.	
24.9	Suitable transverse grab handles, coloured as per Section 15, complying with AS1428.1 must be provided on each bulkhead or screen ahead of any forward facing seats.	
24.10	Any handrail or grab handle where a passenger may strike the handrail or handle in an emergency stop or heavy braking, must comply with TS148.	
24.11	Hanging grab handles or straps and seat mounting grips must be installed in each Bus in accordance with standing capacity.	
24.12	The hanging grab handles or straps mounted to the longitudinal hand rails must equate to a minimum of 65% of the total standing capacity.	
24.13	Seat mounted grips must be aisle side mounted.	
25.	**BUS STOP REQUEST BUTTONS**	

25.1	Bus stop request buttons to alert the driver a passenger requests the Bus to stop must be fitted to all stanchions (where fitted), adjacent to seats and designed not to be susceptible to accidental or false activation. All seats must have access to bell push button.	
25.2	At the rear five passenger seat, bus stop request buttons to be fitted on the left and right hand sides of the bus.	
25.3	Bus stop buttons must have a casing coloured as per Section 15, to provide conspicuity for the button and also provide contrast to identify the vertical handrails.	
25.4	Operation of any stop button must activate a Bus Stopping Sign, mounted at the front of the Bus, to illuminate until the door is opened.	
25.5	The Bus stop button must also provide an audible tone for all passengers and a warning light for the driver on the dashboard.	
25.6	The audio signal will cancel after the first activation and reset when the door has been opened and closed.	
25.7	The left hand side and right hand side bell push electric circuits must be separated to improve the reliability of the system.	
25.8	Refer to Section 10 for wheel chair Bus stop request button details.	
26. SEATS		
26.1	Except for folding seats in the wheelchair allocated spaces, seats shall be floor mounted with a vertical leg. (cantilever seats are Optional in Section 61)	
26.2	Seats must have vandal-resistant frames and backs. Full size cushions and squabs must be provided and must be easily removable for repair and replacement.	

26.3	Continuous seat rails must be incorporated in the body sides.	
26.4	A moulded grab handle must be fitted to the top of each seat back (exception for the rearmost row of seats).	
26.5	All passenger seats and the driver's seat must be trimmed in moquette over foam upholstery. See Section 11 for Fire Mitigation standards for seats.	
26.6	In addition to the seats in the wheelchair area, at least four (4) designated Priority Seats must be provided in the low floor area of the Bus and as close as possible to the accessible entrance.	
26.7	Priority Seating signage to be provided in accordance with TfNSW internal signage requirements.	
26.8	Particular attention must be paid to ensuring high levels of comfort for seated passengers, including contoured seat padding and adequate knee and leg room. (Refer ADR58/00 for minimum dimensions)	
26.9	Folding seats must be provided in the wheelchair allocated spaces for use when spaces not used by wheelchair passengers. All folding seats, when deployed, must meet the same mounting, strength and impact requirements as the fixed seats.	
26.10	All folding seats must be able to be deployed in both the raised and lowered positions and must not automatically spring back to the folded position.	
26.11	Seatbelted seats shall be fitted, forward facing, in the 2 for 3 format complying with ADR68/00 (retractable lap sash belts) with current Component Registration Numbers (CRN) and signage in bus indicating occupant limitations.	
26.12	Bus structure to which the seats are mounted to have the same characteristics as the test platform used for the ADR68/00 tests. (Refer ADR68/00, Clause 7.1.2)	
26.13	All modesty panels or other structures such as driver cabin protection barriers in the head impact zone to comply with ADR68/00. (Refer Appendix 2, Clause 1 for HIZ).	
26.14	Six seat positions to be fitted with fittings for child restraints in accordance with the requirement of ADR68/00 Clause 5.6 and ADR34/03.	
26.15	To ensure an acceptable level of safety for all three occupants in the 2 for 3 arrangement, NSW has taken a position that the level of occupant protection provided by the centre position needs to have further safeguards and has imposed additional safety requirements. As such all 2 for 3 seats must meet the Australian Design Rule requirements specified below:	

	26.15.1	The rear parts of the seat fitted directly in front of a centre seating position of a 2 for 3 Bus seat must comply with the Energy Dissipation Test of Australian Design Rule ADR 3/04 (Seats and Seat Anchorages) and	
	26.15.2	The centre seating position of a 2 for 3 Bus seat must comply with Australian Design Rule ADR 4/05 (Seatbelts) and Australian Design Rule ADR 5/05 (Anchorages for Seatbelts).	
26.16	A label or sign fitted inside the Bus warning passengers that the 2 for 3 seat can only be used by children under 12 when used in a three seat configuration.		
26.17	In each ADR68/00 installation, seats are to be provided with an aisle side grab handle on every second seat, off-set from left to right so a person moving down the aisle has a hand hold at every seat		
26.18	Buses fitted with seat belts must have an Illuminated FASTEN SEATBELTS sign		
26.19	The bus is to comply with ADR68/00		
27. LUGGAGE RACKS & BINS			
27.1	A luggage rack may be provided as an option (Section 61)		
27.2	Cat 4 School Buses shall be fitted with luggage bins in accordance with chassis configuration, typically 2 doors on each side for ease of handling items.		
27.3	Bins at 27.2 must be individually lockable for security and limiting use on the offside in situations where traffic may pose a risk.		
28. REAR VISION MIRRORS			
28.1	All rear vision mirrors must be in accordance with the Service NSW Technical Specification 147, Field of View of the Passenger Entrance Doors on a Bus.		
28.2	All exterior rear vision mirrors must comply with ADR14/02 for Class II mirrors.		
28.3	To facilitate repair, all components must be separately replaceable and the mirror head must be mounted independently from the mounting bracket.		

28.4	All mirror mountings must be designed to minimise vibration to the mirror head, so the image seen by the driver is reasonably clear at all speeds up to 100km/hr. Refer to clauses 15.1.2 and 15.1.3 in ADR 14/02.		
28.5	Each exterior mirror must have an area of no less than 150cm^2. As per clause 14.4 in ADR14/02.		
28.6	External mirrors must not project more than 230mm beyond the point of the overall width of the Bus and meet the collapse requirement of 28.7 (Refer clause 4.3 in ADR 14/02).		
28.7	External mirrors must be mounted on 'knock-back' arms that will move backwards in the event of impact, and project no more than 150mm from the side of the Bus when collapsed. (Refer clause 4.3 in ADR 14/02).		
28.8	The left-hand, exterior, rear-facing mirror must be a highly durable, impact resistant, heated, electrically adjusted, convex mirror (radius of curvature not less than 1,200mm, (Refer clause 4.5 in ADR14/02), mounted forward of the entrance doors and visible through the windscreen in the wiper-swept area.		
28.9	The left-hand exterior mirror housing material is to be coloured as per Section 14 to improve its visibility for pedestrians.		
28.10	To reduce the likelihood of impact with pedestrians, the lower edge of the left-hand mirror must be no less than 2,100mm from the ground with the Bus standing on level ground and at normal height.		
28.11	ADR14/02 15.2.4.2 Fig.4 specifies the required field of view to the rear and side of the Bus that the driver must be able to observe in the left-hand exterior mirror.		
28.12	The right hand side, exterior, rear- facing mirror must be a highly durable, impact resistant, heated, electronically-adjustable, flat mirror, visible through the driver's side window.		
28.13	The lower edge of the right hand side mirror shall be mounted as high as possible to reduce injury to pedestrians and minimise the driver's forward vision blind spot area.		
28.14	ADR14/02 15.2.4.2 Fig.4 specifies the required field of view the driver must be able to observe to the rear and side of the Bus in the right-hand exterior mirror.		
28.15	Interior mirrors must comprise:		
	28.15.1	A convex mirror mounted centrally on the header panel, above the windscreen, for the driver to see the saloon space;	
	28.15.2	A mirror mounted toward the left hand side of the front header; arranged to allow the driver to observe the mirror at item 3 NB: mirror must be easily adjustable from the front platform or be electronically adjustable;	
	28.15.3	A convex mirror mounted near the centre door arranged to be observed by the mirror at item 2; and	

	28.15.4	A convex mirror mounted near the left hand side to provide the driver with a view of the wheel chair area and the area behind the driver's cabin.	
28.16	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).		
29. INTERIOR LIGHTING			
29.1	Interior lighting must ensure sufficient lighting for all passengers.		
29.2	The interior lighting must be LED and covered by diffusers.		
29.3	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.		
29.4	All lighting elements must be readily replaceable.		
29.5	Light diffusers must be easily removable and replaceable.		
29.6	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.		
29.7	A document reading light must be provided in the drivers' cabin area and must be independently switched at all times.		
29.8	Interior lighting and any accessories must be so designed as to minimise reflections on the front windscreen and side windows adjacent to the driver and to reduce the glare in the driver's field of vision.		
29.9	To test for reflections at 29.8, in a dark environment, turn off all lights and then progressively turn on internal lights, observing from the driver's position windscreen and mirror reflections that may interfere with driver vision.		
29.10	Adequate lighting must be provided in the main Engine/Motor/Energy/Power Cables compartment.		
30. EXTERIOR LIGHTING AND RETROREFLECTORS			
30.1	Any exterior lighting lamp locations, intensities, colours or signalling functions must comply with ADR13/00.		

30.2	In addition to the requirement of 30.1, the individual exterior lighting and retroreflectors on the Bus must comply with:		
	30.2.1	ADR 1/00 Reversing Lamps;	
	30.2.2	ADR 6/00 Direction Indicators;	
	30.2.3	ADR 46/00 and ADR 77/00 Headlamps;	
	30.2.4	ADR47/00 Retroreflectors;	
	30.2.5	ADR48/00 Devices for Illumination of Rear Registration Plates;	
	30.2.6	ADR 49/00 Front and Rear Position (Side) Lamps, Stop Lamps and End-outline Marker Lamps;	
	30.2.7	ADR 74/00 Side Marker Lamps;	
	30.2.8	ADR76/00 Daytime Running Lamps;	
	30.2.9	ADR86/00)Parking Lamps; and	
	30.2.10	Service NSW Technical Specification Warning signs and lights for school buses TS150.	
30.3	All exterior lights must be long life LED type.		
30.4	Side turn and marker lights to be located as close as possible to each front and rear wheel arch respectively to assist the driver when turning.		
30.5	A weather and pressure wash proof external light must be provided adjacent to the Front Door and Centre/Rear Doors, arranged to clearly illuminate the lowest door step edge, as well as the kerb and pavement or road surface, for at least 500 mm beyond the step edge and for at least the full width of the doorway.		
30.6	The light at 30.5 must be an LED type, must only illuminate when the respective doors are opened and the interior lights are on, and be extinguished when the respective doors are closed.		
30.7	Daytime running lamps to improve Bus conspicuity in daylight are to be provided in accordance with ADR 76/00.		

30.8	In addition to standard front direction indicators, high-mounted front direction indicators shall be provided in accordance with ADR13/00 and ADR6/00.		
30.9	In addition to standard rear direction indicators and stop lamps, high-mounted rear direction indicators and stop lamps shall be provided in accordance with ADR13/00, ADR6/00 and ADR49/00.		
31. DRIVER CAB			
31.1	Driver's seat is to be a non-swivel based, spring suspension/air adjustable, type, including a head rest and adjustable lumbar support, suitable for drivers ranging from the 5th percentile female to the 95th percentile male up to150kg. Swivel		
31.2	The driver's seat must be fitted with lap/sash seatbelt with the seat buckle on the left-hand side of the seat.		
31.3	Adjustable blind mounted ahead of the driver to cover approximately 3/4 of screen width, refer to 5.10.		
31.4	Adjustable scissor type blind mounted to the right of the driver, refer to 5.10.		
31.5	Ticketing machine mounting details as per Section 19.		
31.6	Items such as PID controller, two-way radio, EBFSS panel and TPMS panel must be mounted in a position where they can be conveniently viewed and reached as necessary from the driver's normal seated position.		
31.7	Driver's coat hook.		
31.8	Personal driver's locker, with two other lockers to house equipment accessible by operations staff.		
31.9	A document holder capable of holding laminated A4 size documents.		
31.10	Emergency duress alarm radio buttons:		
	31.10.1	A foot activated switch under a flip up foot rest at the driver's left foot location.	
	31.10.2	A 2nd hand activated switch on the dash riser near the driver's left knee.	
	31.10.3	An additional switch and integration of the alarm with horn and headlight flashing functions are included in the Options Section 61.	
31.11	A cup holder arranged so as to minimise the risk of accidental spillage of any fluids over the driver, passengers or equipment.		

31.12	Driver authority card holder of metal material located on the front interior header.		
31.13	A driver's security half (½) screen shall be part of a driver's cabin door and shall open and close with the cabin door. The screen shall provide the driver with a degree of protection against passenger assault but without inhibiting the driver's vision, cause distracting reflections, restrict access for transactions with passengers, or restrict the driver from being able to easily enter and exit the cabin. (For higher risk areas, a ¾ screen may be fitted as per the Options Section 61.)		
31.14	The driver's cab door lock and striker must not present a safety hazard to the driver, particularly to their knees when exiting the cabin. Door locks and latches to be recessed where possible.		
31.15	The driver's cab raised platform shall not intrude into the passenger gangway, and shall be at a height not exceeding 350mm above the gangway.		
31.16	A lockable cash storage bin to allow storage of excess cash (both notes and coins).		
31.17	Signage set out over bulkhead to include these items:		
	31.17.1	Driver Authority Holder and sign	
	31.17.2	Please do not speak to driver whilst Bus is in motion	
	31.17.3	Bus Number	
	31.17.4	Bus stopping sign	
31.18	At the driver's ear, the direction indicator sound level must be between 40 dB(A) and 50 dB(A).		
31.19	At the driver's ear the hand brake warning alarm sound level must be between 70 dB(A) and 80 dB(A).		
31.20	At the driver's ear the wheel chair ramp alarm sound level must be between 70 dB(A) and 80 dB(A).		
31.21	At the driver's ear any alarm sound level must be between 70 dB(A) and 80 dB(A).		
31.22	A rear vision camera must be supplied which diplays the rear view when reverse gear is selected.		

32. ENGINE / MOTOR CONTROLS AND PROTECTION			
32.1	Engine start and stop controls must be provided both in the driver's cab and at the rear of the Bus in the engine bay.		
32.2	Engine start and stop controls must be clearly labelled with the words 'Engine Start' and 'Engine Stop', in English or acceptable pictograms.		
32.3	Each engine stop control must require only a simple action and must be effective immediately.		
32.4	An override switch must be provided near to the rear engine start and stop controls to enable maintenance staff to isolate the start and stop controls in the driver's cab. For ZEBs the switch is to prevent the bus being operated from the driver's		
32.5	The dash console must give fingertip control of all switches and controls and must be ergonomically arranged to optimise access by the driver.		
32.6	The instrument cluster is to be that supplied by the chassis manufacturer and is to be incorporated in a dash riser which has removable panels fitted as required to provide access to components.		
32.7	A fuel and urea (if urea used) gauge(s) must be fitted to the dash panel.		
32.8	A voltmeter must be incorporated in the dash panel with a high/low voltage visual indicator.		
32.9	A system to prevent the engine from being started from the driver's cab when the engine door is open must be provided.		
32.10	It must still be possible to start the engine from the rear engine controls with the rear engine door open.		
32.11	Warning Indicators to show on drivers dash to include:		
	32.11.1	Alternator Not Charging;	
	32.11.2	Engine oil pressure and temperature;	
	32.11.3	Low oil level	
	32.11.4	Transmission oil pressure and temperature;	
	32.11.5	High coolant temperature;	
	32.11.6	Low coolant level;	
	32.11.7	Maximum Road Speed Warning Device (above 60 km/hr) and can be connected with a chime directly;	

	32.11.8	Top speed limiter to ensure set speed limit (A range of 60 km/hr to 100km/hr to allow operators to select maximum speed limits).	
	32.11.9	A warning light will light once the set limit speed is attained.	
32.12	A removable 'Engine/Motor start' key must be fitted or approved Engine/Motor start system. All "Engine/Motor Start" keys and barrels supplied must be identical (subject to Operator agreement), so that any key can start any Bus supplied.		
32.13	Each Bus must be incapable of being started and or driven without the use of the 'Engine/Motor start' key or some other approved Engine/Motor start system.		
32.14	All instruments and controls must be clearly identified by means of pictograms and or signs written in the English language.		
32.15	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 driver's side window.		
32.16	Where an audible warning is provided (e.g. for Bus malfunction, turn indicators, reverse gear, kneeling and lifting, wheelchair ramp operation) 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 80 dbA in cabin area.		
32.17	For ZEBs, the following functional safety requirements are mandatory:		
	32.17.1	Compliance with functional safety requirements of ECE Regulation 100 Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric powertrain	
	32.17.2	Compliance with AS ISO 6469.2:2014 Electrically propelled road vehicles - Safety specifications. Part 2 Vehicle Operational safety means and protection against failures	
	32.17.3	It shall be indicated to the driver, continuously or temporarily, that the propulsion system of the vehicle is ready for driving	
	32.17.4	When leaving the vehicle, it shall be indicated to the driver whether the electric propulsion system is still in the driving-enabled mode	
	32.17.5	if the on-board REESS can be externally charged by the user, vehcile movement by its own propulsion system shall be impossible as long as it is connected	

	32.17.6	the state of the drive direction control unit shall be identified to the driver	
	32.17.7	Power-on procedure of the vehicle propulsion system shall require at least two deliberate and distinctive actions to go from the power-off mode to the drive-enabled mode.	
	32.17.8	Only one action is required to go from drive-enabled mode to power-off mode	
	32.17.9	A main switch function shall be an integral part of the power-off procedure. If the power-on/off procedure of the propulsion system is activated by the car key system, it shall be designed according to the operation safety design.	
	32.17.10	after an automatic or manual turn-off of the propulsion system, it shall only be possible to reactivate it by the power-on procedure, as described	
	32.17.11	If the electric propulsion system is equipped with a means to automatically reduce the vehicle propulsion power, significant reductions should be indicated to the driver	
	32.17.12	If a low state of charge (SoC) in the REESS has a relevant impact on the vehicle driving performance, a low energy content of the REESS shall be indicated to the driver by an obvious device.	
	32.17.13	In Low state of charge (SoC), it shall be possible to move the vehicle out of the traffic using its own power	
	32.17.14	In Low state of charge (SoC), a minimum energy reserve shall still be available for the lighting system.	
	32.17.15	If driving backwards is achieved by reversing the rotational direction of the electric motor, the following requirements shall be met to prevent unintentional switching into revers when the vehcile is in motion:	

	32.17.16	Either two separate actions by the driver, or	
	32.17.17	if only one action is required, a safety device shall allow the transition only when the vehicle is stationary or moving slowly.	
	32.17.19	No unexpected movement of the vehicle due to the electric drive shall be possible after the driver has switched to the power-off mode	
32.18	For ZEB, for pedestrians and road user safety the normally silent operation of ZEBs is to be supplemented by an acoustic noise generator in accordance with ECE Regulation 138 - Uniform provisions concerning the approval of Quiet Road Transport Vehicles with regard to their reduced audibility		
	32.18.1	Acoustic Vehicle Alerting System (AVAS) shall be designed to achieve minimum sound power levels of 50 dBA at 10 km/h and 56 dBA at 20 km/h, up to a maximum of 75 dBA (measured at 2 metres on dense graded asphalt). Spectral component to be designed to prevent tonal components.	
	32.18.2	The sound level and frequency shift shall be designed to reflect the appropriate speed intervals, in order to comply with United Nations Economic Commission for Europe (UN, 2017) Regulation No.138 and Transport for London (TfL, 2017) Guidelines.	
	32.18.3	AVAS to be designed to achieve UNECE regulation NO.138 such that “sounds shall contain at least two of the one-third octave bands between 160Hz and 5000Hz; at least one of the these one-third octave bands shall be below 160Hz”.	
	32.18.4	The sound level and frequency shift shall be designed to reflect the appropriate speed intervals, in order to comply with UNECE Regulation No.138 (UN, 2017)and TfL Guidelines (TfL, 2017).	
33. AIR CONDITIONING HEATING AND VENTILATION			
33.1	The air conditioning system is an very important component for passenger and driver comfort and shall be suitable for a sub tropical environment. It shall be a heat/cool system. It should typically be 40kW for a single deck bus and 55 kW for 14.5 CAB, Articulated Bus and Double Deck bus.		

33.2	The system must include a fresh air intake with at least 10% fresh air makeup to ensure Carbon dioxide levels do not build up.		
33.3	When in the cooling mode, the system shall cool the air at the mid point of the Bus interior to 22°C within 15 minutes from a temperature of 38°C.		
33.4	Relative humidity inside the Bus shall not exceed 60% after fifteen minutes .		
33.5	When in heating mode, the system shall maintain an interior temperature of 23°C when the outside temperature is 5°C, within 15 minutes.		
33.6	Driver's controls must be limited to an 'on-off' switch. The system must be fully automatic in operation		
33.7	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.		
33.8	The conditioned air supply to the driver's cab shall also be provided with a multi-speed booster fan to allow the driver to control air flow rates to the cab.		
33.9	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.		
33.10	The air conditioning system must not be integrated with the multiplexed on board computer, arranged to allow for air conditioning suppliers to independently re-program operating parameters.		
33.11	The ventilation fans must be electronically controlled so as to maintain passenger comfort.		
33.12	The system is to incorporate an air distribution system that:		
	33.12.1	uses fixed grilles or slots in the passenger area.	
	33.12.2	does not allow air to flow directly onto passengers' heads	
	33.12.3	flow is to be balanced down the Bus to allow even distribution of air	

	33.12.4	has three individual adjustable vents for the driver	
	33.12.5	vents designed so that small objects (rubbish) cannot be pushed into the vents.	
	33.12.6	provides a minimum of 8 fresh air exchanges per hour	
	33.12.7	has laminar air flow, ceiling to floor along entire vehicle, multiple return air vents to be equivalent to the number of supply air vents along the bus. (no single location for return air as laminar flow cannot be achieved)	
	33.12.8	has decontamination efficacy removal of 150mg/m3 < or = 2.5 micron within 3 minutes to background levels. Alternatively reduction to 0.01% of 2.5 micron within 3 minutes	
	33.12.9	has filtration efficiency at 0.3 microns equivalent to H17 or 99.995% particle removal at minimum for SARS COV2, Mould, general pollutants, bacteria, (“’Any return air if not fresh air must be filtered first through H17 filter before returning to occupied space”).	
33.13	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.		
33.14	All air must be filtered to trap particles greater than 60 micron, and filters must be easily removable for cleaning and at service intervals of no more than 60 days in operating conditions experienced in route services in NSW.		
33.15	Condensate must not precipitate or collect on any interior surface of the Bus, including the distribution ducts.		
33.16	All 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.		
33.17	A separate heating, windscreen demisting and driver’s ventilation system must be provided at the front of the Bus. The system must:		
	33.17.1	minimise the ingress of traffic fumes by drawing in fresh air at a height of not less than 1.8 metres from the ground;	

	33.17.2	demist the front left hand side ‘peep screen;’	
	33.17.3	demist the front leaf of the front door;	
	33.17.4	demist the driver’s window; and	
	33.17.5	have a multi-speed fan which can be controlled by the driver.	
33.18	For diesel buses, 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.		
33.19	The evaporator and condenser fans must have brushless motors.		
33.20	The air conditioning system must have a low maintenance compressor.		
33.21	For diesel buses, the air conditioning compressor is to be mounted on a robust mounting plate or bracket designed to isolate vibrations from the chassis.		
33.22	For diesel buses, the compressor drive belt configuration must be carefully designed to ensure pulleys are precisely aligned and vibration minimized by appropriate belt length and/or by a belt stabilizing pulley.		
33.23	For ZEBs, The HVAC system is powered electrically by the battery system.		
33.24	For ZEBs, HVAC system must be able to be remotely activated while charging/plugged in for temperature preconditioning, without the possibility that the propulsion system is activated.		
34. ROOF HATCHES			
34.1	The roof hatches must be capable of use as emergency exits, in accordance with ADR44/02 requirements.		
34.2	Roof hatches can be manually operated, non-transparent or bonded fixed glass (emergency break glass for use as emergency exit).		
34.3	Where manual hatch is used, the handles of the roof hatch must be operable by adult passengers in an emergency.		
34.4	The supplier must ensure that each roof hatch and its components are sealed so that no water, from weather or Bus washes is able to penetrate the interior of the Bus or contact any structural members or internal panel surfaces or voids.		
35. DESTINATION EQUIPMENT			
Destination Equipment refers to destination and route signage read from outside of bus.			

35.1	All destination equipment must conform to the Disability Standards for Accessible Public Transport (2002).		
35.2	Destination signs are to be white on black LEDs, high visiblity with integrated light sensors.		
35.3	The front destination sign unit must:		
	35.3.1	be composed of approximately 19 lines x 144 columns of LEDs (pitch 10mm horizontal and 13mm vertical);	
	35.3.2	be capable of displaying four large route number alpha numeric digits and one large or two small lines of text;	
	35.3.3	allow text to be shown as part screen or full screen or a mixture of both;	
	35.3.4	Allow the text to be capable of scrolling with user-configurable timing. For example, the driver must be able to display Route ID and Destination/s and the ability to scroll other message such as “Set Down Only” at timing intervals that make it possible for customers to see both sets of information as Bus approaches the Bus stop; and	
	35.3.5	viewing area 1518mm x 325mm (approximate dimensions)	
35.4	The side unit must be:		
	35.4.1	be composed of approximately 15 lines x 96 columns of LEDs (pitch 10mm horizontal and 13mm vertical);	
	35.4.2	be capable of displaying four large route number alpha numeric digits and one large or two small lines of text;	
	35.4.3	mimic information displayed on the front of the destination unit; and	
	35.4.4	viewing area 974mm x 190mm (approximate dimensions)	
35.5	The rear unit must be:		
	35.5.1	be composed of approximately 17 lines x 32 columns of LEDs (pitch 10mm horizontal and 13mm vertical);	
	35.5.2	be capable of displaying four(4) large route number digits; and .	
	35.5.3	viewing area 340mm x 305mm (approximate dimensions)	
35.6	Each destination unit must be legible within a field of view defined by a cone of angle 150 degrees, the axis perpendicular to the sign, and the vertex located at the centre point of the sign.		

35.7	The destination equipment controller must be capable of storing at least 2,000 separate displays and must be updated by means of a smart card, USB connection, or other easy electronic means.	
35.8	Special attention must be given to providing good access to the destination units for maintenance and repair.	
35.9	Each unit must allow sufficient access to remove display componentry without the need to move any other equipment.	
35.10	Any access door must be retained in such a manner to prevent the unit falling in the driver's field of vision in the event of a Failure.	
35.11	The programming software must be GUI based and must enable easy programming and modifications to the destination lists during programming.	
35.12	The software must emulate on screen what will be seen on the Bus destination signs.	
35.13	The destination control panel inside each Bus must mimic in real time on the screen what is displayed in the front and side destinations.	
35.14	The destination control panel shall be capable of interface and operation of the passenger information next stop visual and voice announcement program as specified in Section 38.	
36. CCTV		
36.1	A suitable Closed Circuit Television (CCTV) to be provided as per document referenced in Appendix 6 .	
36.2	Tenderers are to provide certification that the system meets the requirements of the above document and undertake testing of the system to demonstrate compliance.	
36.3	Any external CCTV Cameras offered while complying with the Specification must remain within the 2,500mm maximum body width.	
37. CORROSION PROTECTION		
37.1	Suitable drainage and ventilation systems must be provided to prevent accumulation or retention of fluids within the Bus structure or panelling. Such systems shall be integral to the Bus structure and must be aesthetic.	
37.2	All closed steel section members, other than stainless steel and aluminium, must be injected with a suitable corrosion inhibitor.	

37.3	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 that they do not represent undue risk to operator's health when used in accordance with manufacturer's procedures.	
37.4	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 or similar.	
37.5	The entire chassis, body and associated equipment must be sufficiently corrosion resistant to withstand regular automated washing using recycled washing water.	
37.6	The IP ratings of all electronics must be rated appropriately as per ISO20653, 2013) and be dust tight. At a minimum, where not covered by standards this should be IP65.	
38. PASSENGER INFORMATION DISPLAY (PID) SYSTEM		
To provide for next stop information to meet DDA requirements in this specification, a PASSENGER INFORMATION DISPLAY (PID) SYSTEM is required:		
38.1	Comply with TfNSW Wayfinding Digital Display Specification referenced in Appendix 3.	
38.2	an LED screen mounted in a purpose designed, aesthetically designed vandal resistant housing is required.	
38.3	The screen is to be of approximately 53cm (21") 1920 x 1080 pixels resolution.	
38.4	The housing is to be fitted at ceiling height above the passenger aisle, approximately over the front axle, on the vehicle centre line.	
38.5	The screen is to be tilted downwards at an approximate angle of 4º relative to a vertical transverse plane.	
38.6	For articulated buses an additional screen is required for passengers in the trailer section.	
38.7	For double deck buses and additional screen is required on the upper deck at the front of the bus.	
38.8	The PID System is to allow the Bus Operator the capability to manage the content of the PID system without the reliance on a third-party or subscription based service. This may include, for example, wi-fi or USB access.	
38.9	Pathways/conduits for the PID are to be connected to this space as identified in Appendix 3, to permit revision of cabling in the future.	
38.10	Screen is to be mounted to withstand 20g accelerations and accommodate the relatively large distortions of the Bus body under the maximum torsional load anticipated in service.	

38.11	The location of the passenger information screens is not to restrict driver's vision of mirrors or monitors used to observe passengers in the bus, particularly passengers using the Centre/Rear Door and wheelchair accessible area.		
38.12	Not used		
38.13	The screens are to show the information required in the document referenced in Appendix 3, including		
	38.13.1	Service	
	38.13.2	Stopping pattern	
	38.13.3	Travelling to	
	38.13.4	Service message	
	38.13.5	Stoppage	
38.14	Remote Communication is to be provided using an on-board SIM and the 5G network to receive updates to the route information sent from a remote location.		
38.15	A driver's interface touch screen to be mounted within comfortable reach of the driver.		
39A. CHASSIS (Including integral configurations) GENERAL			
39A.1	The Engine/Motor shall be located in the bus at the:		
	39A.1.1	front	
	39A.1.2	mid	
	39A.1.3	rear	
	39A.1.4	wheel hubs	
	39A.1.5	other (provide detail)	
39A.2	The Engine/Motor is to be powered by:		
	39A.2.1	diesel	

	39A.2.2	zero emission technology	
39A.3	Each Bus must be designed to permit all mechanical and chassis related maintenance to be carried out via the interior floor hatches and access hatches on the exterior of the Bus using an under floor pit.		
39A.4	Buses may not necessarily be maintained using hoists.		
39A.5	A 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.		
39A.6	Provision must be made to support each axle of the Bus by means of axle stands when any portion of the Bus is lifted.		
39A.7	Each Bus must be designed for emergency towing.		
39A.8	A towing coupling, consistent with the Operator' must be fitted at the front and rear of each Bus.		
39A.9	Two attachment points suitable for safety chains must be provided at the front of the vehicle.		
39A.10	Each Bus must have a front end air coupling consistent with the Operator's standard coupling to release the spring brakes and to enable the air system to be fully charged so that all pneumatically operated equipment can be operated. This coupling shall be appropriately located and easily accessible in the proximity of the tow point.		
39A.11	Each Bus must be geared for maximum economy in normal operation.		
39A.12	Each Bus must have a programmable speed limiting device, and facilitate a programmable top-speed ranging from 60km/h to 100 km/h without affecting the Engine/Motor performance. 100km/hr is the maximum allowable road speed ADR65/00 Clause 65.5.2.		
39A.13	The top speed-limiting device including ECU shall be tamper-proof.		
39A.14	If the engine fuel system governor is electronically controlled, the fuel system must incorporate an emergency engine cut-out device to shut off the fuel supply to eliminate the consequences of unintentional acceleration caused by a fault (electrical/mechanical) in the wiring between the control module and injection pump.		
39A.15	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.		
39A.16	The front number plate is to be mounted in a position and manner to avoid damage when the Bus is being towed. It must not be necessary to use tools to remove the number plate for towing purposes.		

39A.17	The tag axle is to be steerable.		
39B. ZEB CHASSIS (Including integral configurations)			
39B.1	ZEB General		
	39B.1.1	The propulsion system must be powered by an all-electric system. The use of any supplementary diesel or other hydrocarbon-based systems will not meet the ZEB project objectives and undermine the net zero targets of TfNSW.	
	39B.1.2	A high level schedule of key ZEB equipment on the bus is to be provided	
	39B.1.3	Details of driveline arrangement (Single drive via diff or hub motors)	
	39B.1.4	Range for max speed 85km/hr (km)	
	39B.1.5	Range for max speed 100km/hr (km)	
	39B.1.6	REESS Type (Lithium Ion etc)	
	39B.1.7	REESS Manufacturer	
	39B.1.8	REESS Capacity full charge (kWh)	
	39B.1.9	REESS pack size for one unit (L X W X H) (mm)	
	39B.1.10	REESS pack mass for one unit (kg)	
	39B.1.11	Number of packs per bus	

39B.1.12	Location of REESS packs (floor, roof etc – include numbers)	
39B.1.13	Total mass of REESS in bus	
39B.1.14	Time to replace one pack (hours). If in different locations on the bus, provide time for each location.	
39B.1.15	REESS cooling arrangement (air non-fan, fan cooled, liquid cooled etc)	
39B.1.16	Charge rate (fast) (Amps)	
39B.1.17	Charge rate (slow) (Amps)	
39B.1.18	Charge rate (fast) (Hours)	
39B.1.19	Charge rate (slow) (Hours)	
39B.1.20	Standby power consumption information must be provided for any systems (e.g. battery and thermal management) and associated systems processes and/or warnings if approaching low critical state of charge.	
39B.1.21	To preserve battery, energy draw when the bus is not turned on must be minimal. Requiring OEMs to provide trickle power requirements allows like-for-like comparison. Safety systems may require the battery is never fully depleted to ensure appropriate thermal management.	
39B.1.22	Battery packs must be easily replaceable with minimal modification to subsystems	
39B.1.23	The appropriate battery storage charge level and conditions must be stated for each bus configuration.	

39B.1.24	ZEBs must be able to accept and manage power from a nominal 75 kW charger and must also accept and manage power from a nominal 150 kW charger.	
39B.1.25	ZEBs must have a minimum of one charging receptacle located on the exterior of the ZEB below window-level at the rear left and use the CCS 2.0 plug type (DC), which is not accessible unless opened for charging. OEMs are encouraged to offer a secondary receptacle.	
39B.1.26	The battery, and all circuitries shall be secured and enclosed such that they cannot be easily accessed without specialist tools.	
39B.1.27	Batteries must be protected from crash and puncture damage, and significant loss of containment must not occur. This is in accordance with the requirements of ECE Regulation 100 and AS ISO 6469.1:2014	
39B.1.28	The propulsion system is able to detect significant faults and disengage by interlock if malfunctioning or operating dangerously. It will indicate to the driver/operator that it is disengaged.	
39B.1.29	NSW Road Rules (Regulation 108) requires, when sign-posted, for buses to control descent on a steep hill by selecting low gear and not using the primary brake. Please indicate if the chassis can comply with this requirement and describe how it is achieved.	
39B.1.30	There must be an external, standard and easily accessible (tamper-proof with key) physical fuse pull switch to completely disengage electrical systems. In addition to the tamper-proof emergency fuse-pull switch, TfNSW may also wish to consider emergency stop buttons that disengage the propulsion system from the battery for safety purposes. These may be positioned for accessibility to the driver and maintenance staff.	

	39B.1.31	High voltage components must be appropriately isolated/physically separated and clearly identifiable from other components of the bus.	
	39B.1.32	The bus has the functionality to discharge the battery to reduce the State of Charge (SoC) in the event of fault/collision/ maintenance. It is acknowledged additional supporting equipment would be required.	
	39B.1.33	Supplier to provide clear guidelines, testing procedures, tools and software for the operator to detemine if a battery remains safe to use after a fault or accident. Alternatively suppliers may provide third-party service when this validation is required.	
	39B.1.34	The OEM shall dictate the battery minimum and maximum state of charge limits which would prevent the battery battery being charged or discharged.	
	39B.1.35	There is a warning system that alerts drivers to low battery state of charge (SoC), equivalent to a low fuel light, where drivers should seek operational guidance (e.g. return to depot).	
	39B.1.36	Not used	
	39B.1.37	Between the maximum state of charge (SoC) at start-of-life degradation state and warning SoC, a 300km range must be achieved under normal operating conditions defined in Section 4.	
	39B.1.38	All buses must be able to be fully charged at a minimum 0.25C rating for normal operations, at an OEM specified constant current.	

	39B.1.39	Articulated buses must be able to be fully charged at a minimum 0.25C rating for normal operations, at an OEM specified constant current.	
	39B.1.40	Articulated buses must be able to be fully charged at a minimum 0.5C rating if opportunity charging, at an OEM specified constant current (i.e. once a week).	
	39B.1.41	All battery and propulsion related warnings must also be on the dashboard. This includes any critical warnings related to vehicle performance and dangerous operation that requires action.	
	39B.1.42	Battery level, remaining vehicle range, and current energy consumption must be available and displayed on the driver dashboard.	
39B.2	For ZEB, REESS capacity degradation (expected % remaining capacity for the number of charge cycles listed)		% REESS capacity
	39B.2.1	After 0 charge cycles	
	39B.2.2	After 1000 charge cycles	
	39B.2.3	After 2000 charge cycles	
	39B.2.4	After 3000 charge cycles	

	39B.2.5	After 4000 charge cycles	
39B.3	For ZEB, electric bus support and spare parts supply details:		
	39B.3.1	Battery testing	
	39B.3.2	Supply replacement batteries or components.	
	39B.3.3	Battery Recycling/Repurpose	
	39B.3.4	Technical support and training	
39B.4	For ZEB, suppliers shall provide the high level details of risk assessements for the systems proposed, covering aspects such as:		
	39B.4.1	high pressure storage of gas	
	39B.4.2	flammable gas (for example hydrogen)	
	39B.4.3	explosive mixtures (for example, hydrogen and oxygen)	
	39B.4.4	management of high voltage electric energy stored in batteries, providing REESS design details that reduce the risk of high temperatures and potential for thermal runaway.	
	39B.4.5	charging and refuelling systems	

	39B.4.6	in service risks/emergency recovery	
	39B.4.7	collision risks- vehicles, overhead bridges	
	39B.4.8	detail the standards used for the significant risk items	
39C. REESS (Rechargeable Energy Storage System)			
39C.1	For ZEBs, compliance with the REESS requirements of ECE Regulation 100 Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric powertrain and AS ISO 6469.1:2014 On-board rechargeable energy storage system (RESS) are required, including the relevant items below:		
	39C.1.1	Compliance with the REESS requirements of ECE Regulation 100	
	39C1.2	Compliance with AS ISO 6469.1:2014	
	39C1.3	vibration	
	39C1.4	thermal shock and cycling	

39C1.5	mechanical impact (crash) including passengers, third parties and short circuit protection.	
39C1.6	fire resistance - see Section 11	
39C1.7	external short circuit protection	
39C1.8	overcharge protection	
39C1.9	over-discharge protection	
39C1.10	over-temperature protection	
39C1.11	emission	
39C1.12	Clearance and creepage distance of solid insulating materials between conductors	
39C1.13	Requirements for the emission of hazardous gases and other hazardous substances	

	39C1.14	Heat generation	
	39C1.15	REESS over-current interruption	
39C.2	For ZEBs, A battery management system must be provided for safety and reliability outcomes. It shall always be fully functional and capable of the following at a minimum:		
	39C2.1	Ensuring safe and reliable performance, including monitoring, recording, and balancing power in the battery and distributing to the transmission system	
	39C2.2	Communicate the state of charge, estimated range remaining, and estimated energy consumption	
	39C2.3	Alert driver/maintenance staff to critical danger that requires immediate action	
	39C2.4	Monitor voltage of all cells	
	39C2.5	Prevent charging outside of the prescribed range or temperatures	

	39C2.6	Provide monitoring of battery health post crash	
39D. ZEB ELECTRIC SHOCK PROTECTION			
39D.1	For ZEBs, the Shock Protection requirements of ECE Regulation 100 Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric powertrain and AS ISO 6469.3:2014 Protection of persons against electric shock are required, including the relevant the items below:		
	39D.1.1	Compliance with the shock protection requirments of ECE Regulation 100	
	39D.1.2	Compliance with AS ISO 6469.3:2014	
	39D.1.3	Marking of Class B items and enclosures (lightening bolt)	
	39D.1.4	Orange cables for Class B circuits	
	39D.1.5	Protection under single-failure conditions	

39D.1.6	Alternative approach for protection against electric shock	
39D.1.7	Requirements for insulation	
39D.1.8	Requirements for barriers/enclosures	
39D.1.9	Isolation resistance requirements	
39D.1.10	Requirements for insulation coordination	
39D.1.11	Requirements of potential equalization	
39D.1.12	Requirements for vehicle power inlet	
39D.1.13	Rest procedures for the protection measures against electric shock	

	39D.1.14	IPXXD (wire) inside pax compartment	
	39D.1.15	IPXXB (finger) outside pax compartment	
	39D.1.16	Connectors including charging socket	
	39D.1.17	Service disconnect IPXXB	
	39D.1.18	Grounding to prevent indirect shock	
39D.2	For ZEBs, the requirements of AS 5732:2015 Electric Vehicle Operations - Maintenance and repair shall be covered as a minimum, in service instructions provided by the manufacturer. These include electric shock and electrolyte injury prevention:		
	39D.2.1	ZEB Safe Working Practices	
	39D.2.2	ZEB Service Working Areas	

	39D.2.3	ZEB Repair	
	39D.2.4	ZEB Handling / Managing Damaged High Voltage Batteries	
39E. ZEB Data Requirements			
39E.1	For ZEB, suppliers shall ensure each bus provides data to comform with the reporting requirements for NSW Bus Operators (Operator Self-reporting Interface Specification for Zero Emission Bus (Azure) Version 0.4 03-12-2021). The output requirements must include the following data:		
	39E.1.1	READING_DATETIME: The date and time point at which the data is read/captured.	
	39E.1.2	BUS_ID: The unique identifier code of the bus as agreed with PTIPS and ETS.	
	39E.1.3	ODOMETER: The total number of kilometres travelled by BUS_ID throughout the life of the vehicle to that particular READING_DATETIME.	
	39E.1.4	STATE_OF_CHARGE: The state of charge of BUS_ID at that particular READING_DATETIME.	
	39E.1.5	STATE_OF_CHARGE_CONSUMED: The total state of charge consumed by BUS_ID throughout the life of the vehicle to that particular READING_DATETIME or since the telemetry was initialised on the vehicle (i.e. cumulative data).	

39E.1.6	ENERGY_CONSUMED: The total net energy consumed by BUS_ID throughout the life of the vehicle to that particular READING_DATETIME or since the telemetry was initialised on the vehicle (i.e. cumulative data). This reading includes the effect of regenerated energy and energy consumed while driving and idling.	
39E.1.7	ENERGY_CONSUMED_DRIVING	
39E.1.8	ENERGY_CONSUMED_IDLING: The total energy consumed for idling by BUS_ID throughout the life of the vehicle to that particular READING_DATETIME or since the telemetry was initialised on the vehicle (i.e. cumulative data).	
39E.1.9	ENERGY_REGENERATED_DRIVING: The total energy regenerated by BUS_ID throughout the life of the vehicle to that particular READING_DATETIME or since the telemetry was initialised on the vehicle (i.e. cumulative data).	
39E.1.10	ENERGY_CONSUMED_HVAC: The total energy consumed for HVAC systems (e.g. air conditioning) by BUS_ID throughout the life of the vehicle to that particular READING_DATETIME or since the telemetry was initialised on the vehicle (i.e. cumulative data).	
39E.1.11	ENERGY_CHARGED: The total energy charged to BUS_ID throughout the life of the vehicle to that particular READING_DATETIME or since the telemetry was initialised on the vehicle (i.e. cumulative data).	
39E.1.12	CHARGE_CYCLE: The total charge cycle of BUS_ID throughout the life of the vehicle to that particular READING_DATETIME or since the telemetry was initialised on the vehicle (i.e. cumulative data).	
39E.1.13	CELL_TEMPERATURE_MAX: The maximum cell temperature of that particular BUS_ID at that particular READING_DATETIME.	

	39E.1.14	OUTSIDE_TEMPERATURE_MAX: The maximum outside or ambient temperature of that particular BUS_ID at that particular READING_DATETIME.	
39E.2	Additional Data Requirements		
	39E.2.1	ZEBs must be able to record and transmit in near real-time the above data to the depot management system including the GPS/location.	
	39E.2.2	ZEBs must record energy consumption rate data, between each charge. This must include time connected to charger, initial state of charge (SoC), end SoC, total consumption and distance travelled. This data shall be recorded between each charge and be tied to bus ID, and GPS telemetry (location and time) on the distance and route travelled. Must be provided in an accessible format, preferably wirelessly and automatically.	
	39E.2.3	ZEBs must record and provide their battery health on a regular basis (to be proposed by the OEM). Tied to Bus ID, must be provided in an accessible format, preferably wirelessly and automatically.	
	39E.2.4	All data required in this specification shall be available to TfNSW.	
	39E.2.5	Data systems shall be highly resilient, and redundancy protected, containing self-reset health check functions to automatically reset if a problem is detected or data is not being recorded. This will include considerations for cyber security.	

	39E.2.6	OEMs must indicate the communication system uptime Service Level Agreement to be expected as a percent (excluding maintenance), the automated recovery process, and the recovery time where maintenance is required	
	39E.2.7	OEMs will provide information on how real-time data is sent, including sampling rates, relay frequency, buffering rates, and delay information.	
40. ENGINE / MOTOR / DRIVE COMPARTMENT			
40.1	The design of the Engine/Motor/Drive 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. Refer Section 10.		
40.2	Insulating materials used in or near to the Engine/Motor/Drive 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. Refer Section 10.		
40.3	All fluid lines shall be rigidly supported to prevent chafing damage, fatigue Failures, degradation and tension strain. Lines shall be sufficiently flexible to minimise mechanical loads on the components. Lines passing through a panel, frame or bulkhead shall be securely protected to prevent chafing and wear. Pipes and fluid hoses shall not be bundled with or used to support electrical wire harness.		
40.4	All hoses, pipes, lines and fittings shall be specified and installed as per the manufacturer's recommendations.		
40.5	The Engine/Motor/Drive compartment must be suitably sealed to prevent ingress of fumes or gases into the passenger compartment.		
40.6	A suitable smoke test is to be conducted to ensure the requirements of 40.5 are met.		
40.7	All hydraulic hoses to comply with AS3791 noting in particular that hoses shall be marked as per clause 1.6 in AS3791 be compliant with the pressure, temperature and performance ratings specific to the application, be provided with a stripe to indicate twisting and be installed without exceeding the minimum bend radius for the class of hose.		
40.8	Any battery venting must be safely managed and not occur inside the passenger compartment.		
40.9	Any battery venting that occurs must be reported by the Battery Management System.		

41. FUEL		
41.1	Each fuel tank must be adequately baffled against surge.	
41.2	The fuel fill point must below the waist rail and be located on the right hand side of the bus	
41.3	A stainless steel panel must be fitted around and below the fuel fill point to prevent degradation of the Bus paint.	
41.4	If urea is used the fill point must incorporate an appropriate magnetic collar;	
41.5	Fill point to be on the right hand side of the Bus;	
41.6	Fuel fill point have a quick release filler cap that is adequately secured so it cannot become detached; and	
41.7	A stainless steel panel must be fitted around and below the urea fill point to prevent degradation of the Bus paint.	
41.8	It is preferable that the fuel and urea fill points are within close proximity to each other, preferably within 1 metre.	
41.9	The fuel filler point and spout must be arranged so that a straight cylinder of 70mm diameter can be inserted for a distance of 200 mm.	
41.10	The fuel filler point and spout must be arranged for use with a high speed refuelling system nozzle which delivers fuel at a minimum rate of 100 litres / minute. At this rate of fill, no “blow back” of fuel must be experienced.	
41.11	The fuel filler shall have a quick release filler cap that is adequately secured so it cannot become detached	
41.12	No part of the fuel system to be located in the driver’s cab or the passenger compartment.	
41.13	All parts of fuel system be protected from damage caused by contact with ground or from debris, and from fatigue or wear generated in normal service.	
41.14	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 or tyres.	
41.15	All hoses and pipes and connections must be located to facilitate visual inspection, disconnection and re-connection without dismantling any covers, ducts or similar components, other than service hatches.	
41.16	Fuel hoses must be compliant with the relevant sections of SAE J30 .	

41.17	Fuel hoses, fuel lines must be routed away from any hot items like manifolds and turbo chargers to avoid fuel heating and risk of fire if a leak develops;	
41.18	Fuel hoses and lines be protected from abrasion and damage; and	
41.19	be supported at least every 600 mm with flexible mounts.	
41.20	A protection plate must be fitted under the fuel tank to prevent damage to the tank underside.	
41.21	Fuel tanks shall be manufactured from low carbon rolled steel.	
41.22	The Nominal Fuel Tank Capacity shall be sufficient to meet the operating requirements in Section 5. It is anticipated the fuel tank volume would be a minimum of 250 litres.	
42. COOLING SYSTEM		
42.1	Regardless whether a Bus is stationary or in motion, the cooling system must be designed so that the Bus does not overheat when in continuous operation under the operating conditions detailed in Section 4, with air conditioning on full power and the Bus fully laden.	
42.2	The cooling system must incorporate a suitable drive system that will require no adjustment between scheduled services.	
42.3	The radiator and fan drive must be located in such a way that they are protected from accident damage or damage shall be minimised in the event of a collision.	
42.4	Radiator air intake systems must be designed so as to minimise ingestion and accumulation or blockage by debris and particles normally encountered in road operations. The fitting of an additional filtering screen is permitted providing the screen can be easily removed or cleaned.	
42.5	Preference is for the radiator to be mounted on the driver's side of the Bus.	
42.6	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.	
42.7	Where coolant lines/hoses pass over hot items, careful design is required to eliminate joints and ensure the materials of the coolant lines/hoses are made of materials suitable to withstand the heat generated and adequately shielded.	

42.8	The radiator must not require cleaning externally more frequently than once every 30,000 km with all coolant hoses being of the silicon type and pipes to be made of stainless steel or other materials which will not deteriorate.		
43. TRANSMISSION			
43.1	The Transmission must be an electronically controlled, automatic transmission, integrated into the engine management system. The transmission must be capable of effective control and adjustment of acceleration, deceleration and road speed in all gears and modes.		
43.2	The transmission must incorporate an integral hydraulic retarder. The operation of the retarder shall be controlled by the application of the brake pedal. The retarder settings shall be pre-set and the driver shall not be able to override the operation of the retarder.		
43.3	The transmission selector must be of the push button type located to the right of the steering wheel. Separate buttons for Reverse, Neutral and Drive movement are required.(RND)		
43.4	The transmission must be in neutral before the engine can be started, and cannot be started in Drive or Reverse.		
43.5	It must not be possible to:		
	43.5.1	Engage reverse while the Bus is moving forward at speeds over 5 km/h;	
	43.5.2	Engage forward while the Bus is moving backwards at speeds over 5km/h; and	
	43.5.3	Reverse at a speed in excess of 5km/h.	
43.7	The transmission must be controlled to not suffer damage if:		
	43.7.1	Reverse gear is selected while the Bus is moving forward; or	
	43.7.2	Forward gear is selected while the Bus is moving backwards.	
43.8	An audible reversing alarm must be fitted, integrated with the on-board management system (where fitted) and arranged to sound whenever reverse is selected.		
43.9	The automatic transmission must be controlled to prevent engine over- revving in the intermediate gears and gear selection is not possible unless the engine is at idle.		
43.10	The transmission and oil specified shall be designed to minimise oil changes to at least 30,000 km.		

43.11	The transmission is not expected to require overhaul until 750,000km or greater.	
44. STEERING		
44.1	The Bus must be fitted with power-assisted steering which permits manual steering in the event of a Failure of the power-assistance.	
44.2	The steering system must comply with ADR 90/00 .	
44.3	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.	
44.4	Clear vision of essential instruments in particular the speedometer must be maintained throughout any adjustments.	
45. AIR SYSTEM		
45.1	The design of the air system must be such that the air compressor is provided only with clean and filtered air.	
45.2	Compressed air must pass through an oil water separator with automatic drainage before entering the air system.	
45.3	The air system must be able to be fully charged from empty within three minutes.	
46. BRAKING SYSTEM		
46.1	The braking system must comply with ADR35/06 Commercial Vehicle Brake Systems	
46.2	The Bus must have a Vehicle Stability Function as per the requirements of Appendix 3 in ADR35/06	
46.3	The Bus must have Electronic Braking System (EBS).	
46.4	The Bus must have Electronic Anti-Lock Braking (ABS) on all wheels.	
46.5	The Bus must have disc brakes on all axles.	
46.6	All brake pad clearances must automatically adjust.	
46.7	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.	

46.8	Under normal operating conditions, there must be minimal brake noise from the discs or pads during service or emergency braking.		
46.9	Air pressure gauges must be fitted in the driver's instrument panel, showing brake circuit pressure for each axle.		
46.10	Alternatively, an air pressure gauge must be fitted to the driver's instrument panel that shows the lowest of the air pressures for each axle.		
46.11	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. The brakes must be able to be released by appropriately trained staff in the event of a complete loss of air pressure.		
46.12	All disc pads must provide a minimum services life of 50,000 km when used in normal operations before replacement is necessary.		
46.13	A fail-safe parking brake must be fitted on each Bus.		
46.14	The parking brake control must be located to the right of the steering wheel and within easy reach of the driver.		
46.15	If the parking brake control is not in the applied position and the 'Engine/Motor/Drive start' key is turned off or the Engine/Motor/Drive 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 place in the applied position. The alarm must continue to sound if the battery master switch is switched off.		
46.16	An audible alarm must be activated whether the engine is running or stopped, when the driver's cabin door is open and/or or the driver's seat belt is unbuckled and the park brake is not applied.		
46.17	This alarm must be deactivated by the application of the park brake when the cabin door is closed.		
46.18	A separate driver operated 'Bus Stop' brake must not be fitted.		
46.19	A "Blocking" or "Broms" valve system must be fitted into the handbrake circuit to help prevent a Bus "run-away" or "roll-away" event while the Bus is charging the brake air system .		
46.20	The Supplier must provide details of offered "Broms" solution, or solutions, with system diagrams.		
46.21	For ZEBs,		
	46.21.1	Regenerative braking to be included in addition to mechanical friction braking.	

	46.21.2	The regenerative braking system should be able to be overridden by ABS and traction control options.	
	46.21.3	Regenerative braking must not be able to overcharge the battery pack to prevent adverse incidents. If there is a chance of overcharge standard mechanical braking to take over automatically.	
	46.21.4	When brakes are engaged in any capacity brake lights must engage. This includes when regenerative braking is in action and the bus is decelerating, even if the driver has not physically depressed the brake pedal.	
47. SUSPENSION			
47.1	High quality ride characteristics typical of a multi air bag system per axle is required.		
47.2	A self-levelling electronically controlled suspension system must be fitted to each Bus.		
47.3	The suspension system must permit:		
	47.3.1	'Kneeling' at the front doorway to achieve a maximum step height of 320mm;	
	47.3.2	A 'suspension lift' setting to raise the Bus over obstructions (with a minimum of 80mm raising of the Bus from the normal ride height).	
47.4	Be prevented from moving with the suspension 'kneeling' and must be prevented from 'kneeling' while moving.		
47.5	Be restricted to moving at speed up to 30 km/h with the suspension in the 'lift' condition.		
47.6	The 'lift' function may be activated at any speeds up to 30km/h.		
47.7	It must not be necessary to stop the Bus to activate the 'lift' function.		
47.8	If the 'lift' setting is operated while the Bus is moving at a speed greater than 30 km/h it must not activate.		
47.9	If the lift function has been activated the Bus must return to normal height above 30km/h and not reactivate until the raise switch is operated again.		
47.10	The time to lower each Bus from the normal height to the 'kneeling' height must not exceed five seconds, and the time to raise the Bus from the 'kneeling' height to the normal height must not exceed five seconds.		

47.11	The time to raise the Bus from the normal height to the 'lift' height must not exceed five seconds, and the time to lower the Bus from the 'lift' height to the normal height must not exceed five seconds.	
47.12	Visual warnings must be provided to alert the driver that the Bus' suspension is either in the 'kneeling' or the 'lift' condition.	
47.13	To prevent passenger injury due to tripping or foot entrapment movements to the kneeling position must be in one constant movement and no adjustment of level (hunting) is permitted in the kneeled state.	
48. WHEELS AND TYRES		
48.1	All wheels may be fitted with 8.25 steel rims.	
48.2	Tyres to be compliant with ADR 95/00	
48.3	Tyres to be Urban rated 295/80R 22.5. and minimum loading code of 152/148.	
48.4	All wheels and tyres must be identical and interchangeable between all wheel positions.	
48.5	Each Bus to be delivered with one (1) spare wheel and tyre combination.	
48.6	All wheel arches to be designed and constructed to prevent damage to the Bus in the event of a tyre Failure. .	
48.7	Dress rims on single wheel hubs are required to provide for fitment of wheel nut retaining devices on all but two opposing wheel studs.	
49. EXHAUST		
49.1	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.	
49.2	Materials used to shroud the exhaust must not absorb or retain flammable or combustible material.	
49.3	The engine air intake must comply with the chassis manufacturer's recommendations in relation to the current emission standard and shall include a water trap.	
49.4	The exhaust must be compliant with ADR58/00. The 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.	
50. ELECTRICAL		

50.1	Each Bus must be provided with a 24 volt DC electrical system with electrical cables and wiring in accordance with SAE J1292 Automobile and Motor Coach Wiring specification and ASA standard T BU FL 01701 ST Mounting and Installation of Electrical Equipment.	
50.2	All electrical cables and wiring shall be in accordance with SAE J1292 and ECE R107, be well insulated and shall be able to withstand the temperature and humidity conditions to which they are exposed. In the Engine/Motor/Drive compartment, particular attention shall be paid to their suitability to withstand the environmental temperature and the effects of all likely contaminants, including pressure cleaning.	
50.3	No cable used in an electrical circuit shall carry a current in excess of that acceptable for such a cable in the light of its mode of installation and the maximum ambient temperature. Refer SAE J1292 and ECE R107.	
50.4	Cable insulation is to be suitable for the vehicle's working environment, considering physical and environmental factors including flexing, heat, cold, bending, risk of oil and fuel contact, abrasion, short circuit and pinch resistance. Refer SAE J1292.	
50.5	All electrical cables shall be so located that no part can make contact with any oil, fuel line or brake air line or any part of the exhaust system, or be subjected to excessive heat, unless suitable special insulation and protection is provided, as for example to a solenoid–operated exhaust valve. Refer ECE R107.	
50.6	The routing of cable harnesses shall be designed to allow replacement without the need to cut terminals from the cables.	
50.7	The routing of cable harnesses shall be designed such that they are not adversely affected by fumes or heat and connectors are protected from areas of high water spray, dirt throw or under chassis cleaning.	
50.8	Cables shall be of fire, fuel and oil resistant material. They shall also meet SAE J1292 and resistant to flame propagation ISO 6722-2006 .	
50.9	Cables located adjacent to the engine shall be thermally insulated, shielded from oily deposits, and properly separated from possible heat source e.g. turbocharger, exhaust.	
50.10	Cable clamps and supports must be non-conductive. Coated steel P-clamps for example are not permitted.	
50.11	Cables that pass through openings or gaps shall be secured/protected with oil and heat-resistant grommet/protective edge sleeving.	
50.12	Cables shall be supported at intervals of not more than 600mm. ADR42/05.	

50.13	All cables within the Engine/Motor/Drive compartment must be protected from crash damage to prevent imminent short-circuit and have easy access for maintenance.		
50.14	High amperage cabling:		
	50.14.1	All high amperage cabling such as main starter cable and alternator cables shall be separated from each other and also from the other auxiliary cables.	
	50.14.2	All high amperage cabling shall be protected by insulation which is highly abrasion resistant and fire retardant.	
50.15	Adhesives are not be used in any fastener supporting cables.		
50.16	Every electrical circuit feeding an item of equipment other than the starter, the ignition circuit (positive ignition), the glow plugs, the engine stopping device, the charging circuit and the battery earth connection shall include a fuse or circuit breaker. Circuits feeding other equipment may, however, be protected by a common fuse or circuit breaker, provided that their sum rated capacity does not exceed the capacity of the fuse or circuit breaker. In the case of multi-plexing, the manufacturer shall give all the relevant technical information. Fusible links to meet or exceed SAE J1656, Circuit Breakers SAE J553. Refer ECE R107.		
50.17	Where the voltage exceeds 100V RMS in one of more electrical circuits in the bus, a manually operated isolating switch which is capable of disconnecting all such circuits from the main electric supply shall be connected in each pole of that supply which is not electrically connected to earth, and shall be located inside the Bus in a position readily accessible to the driver, provided that no such isolating switch shall be capable of disconnecting any electrical circuit supplying the mandatory external lights and warning systems. This clause does not apply to high tension ignition circuits nor to self-contained circuits within a unit of equipment in the vehicle. Refer ECE R107.		
50.18	All body electric components shall be suitable for the chassis and match the functions of the chassis so the Bus operates efficiently and effectively.		
50.19	Design of the electrical, electronic and data communication systems shall be modular so that each electronic device, apparatus panel, or cable loom is easily separable from interconnected items by means of connectors.		

50.20	The battery capacity and alternator output must be sufficient 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, measured over a period of 30 minutes.		
50.21	The chassis shall have a reliable Bus Electrical Architecture or CAN system that allows the different control units to communicate with the various functions via a complete network or control unit network. The system provided shall consider;		
	50.21.1	Minimal cabling;	
	50.21.2	Standardised components (control units, hardware); and	
	50.21.3	Flexibility to change by variant.	
50.22	Control units shall be positioned as close as possible to the functions they control in order to minimise the length of cable between control units and components.		
50.23	The system architecture shall be able to connect, but not limited, to the following control units;		
	50.23.1	Panel instruments;	
	50.23.2	Drive line;	
	50.23.3	Engine;	
	50.23.4	ABS/ECS;	
	50.23.5	Retarder;	
	50.23.6	Transmission;	
	50.23.7	Chassis;	
	50.23.8	Body builder Electrical Controls;	
	50.23.9	Electronic Destination sign;	
	50.23.10	GPS or Vehicle Location System;	
	50.23.11	Fare collection equipment;	

	50.23.12	Vehicle Management System with Cellular communications (5G and WiFi);	
	50.23.13	Intelligent Priority system (PTIPS) / Passenger Information Display System;	
	50.23.14	Broadcasting devices;	
	50.23.15	Air-conditioning system; and	
	50.23.16	Auxiliary +24Vdc power supply.	
50.24	All serial communication data links shall conform to SAE J1708 and SAE J1939.		
50.25	The communication links are to be grouped in logical levels so that chassis drive line data is separate from operational body data and both are separated from information or accessory data. This hierarchy is to ensure the more important operations of the Bus are isolated from Failures in the less critical levels.		
50.26	Versatility and future expansion shall be provided for expandable system architecture. The multiplex system shall be capable of accepting new inputs and outputs through the addition of new modules and or/ the utilisation of existing spare inputs and outputs.		
50.27	All like components in the multiplex system shall be modular and interchangeable with self-diagnostic capabilities. The modules shall be easily accessible for troubleshooting electrical Failures and performing system maintenance. Multiplex input/output modules shall use solid-state devices to provide extended service life and individual circuit protection.		
50.28	Data access shall be made available via a communication port on the multiplex system. The location of the communication port shall be easily accessible.		
50.29	Diagnostic and Fault Detection – The multiplex system shall have a proven method of determining its status (system health and input/output status) and detecting either active (online) or interactive (offline) faults through the use of on/board visual/audible indicators.		
50.30	In addition, to the indicators, the system shall employ an advanced diagnostic and fault detection system, which shall be accessible via either a personal computer or handheld unit. Either unit shall have the ability to check logic function. The diagnostic data can be incorporated into the information level network or the central data access system.		
50.31	The multiplex system shall have security provisions to protect its software from unauthorised changes. This shall be achieved through any or all of the following:		

	50.31.1	password protection;	
	50.31.2	limited distribution of the configuration software;	
	50.31.3	limited access to the programming tools required to change the software; and	
	50.31.4	hardware protection that prevents undesired changes to the software.	
50.32	Provisions for programming the multiplex system shall be possible through a PC or laptop. The multiplex system shall have proper revision control to ensure that the hardware and software are identical on each vehicle equipped with the system. Revision control shall be provided by all of the following:		
	50.32.1	hardware component identification where labels are included on all multiplex hardware to identify components;	
	50.32.2	hardware series identification where all multiplex hardware displays the current hardware serial number and firmware revision employed by the module;	
	50.32.3	software revision identification where all copies of the software in service displays the most recent revision number; and	
	50.32.4	a method of determining which version of the software is currently in use in the multiplex system.	
50.33	Alternators shall be weather-resistant type with double sealed type long life bearings.		
50.34	Combined alternator output typically will be greater than 360 amps, however supplier shall provide design rationale for alternator selection .		
50.35	If multiple alternators are used, Supplier shall explain how the alternators will be regulated so no one alternator will be over worked.If multiple alternators are used, Supplier shall explain how the alternators will be regulated so no alternator is over worked.		
50.36	Charge regulators to be fully solid state, silicon based and transistorised with temperature compensation and complete with over voltage control protection.		
50.37	Engine starter motor shall have starter interlock to prevent engagement while engine is running.		
50.38	Batteries shall be maintenance free type with minimum capacity 200Ahr each. Alternative battery management system may be offered (for example to support I-Start or similar if offered).For State Transit, batteries to be 2 x 12 volt AGM HVT-225D.		
50.39	Battery safety:		

	50.39.1	Battery terminals shall be protected to prevent short-circuit.	
	50.39.2	There shall be sufficient clearance between the top of the battery terminals and the body to prevent accidental shorting due to movement of the battery crate	
	50.39.3	Battery tray shall not corrode throughout the lifespan of the bus, and be provided with an insulating top cover.	
50.40	The battery compartment shall be separated from the passenger and driver compartment and ventilated to outside air.		
50.41	The batteries shall be mounted in a swing-out or pull out-crate for access and maintenance to allow the batteries to be individually replaced without disturbing the other battery.		
50.42	The crate and hatch shall be lockable when secured.		
50.43	Battery cables shall be supported to ensure that the cables do not chafe during the pulling out of the battery crate / tray.		
50.44	A battery isolating switch shall be provided adjacent to the batteries to isolate power to the Bus		
50.45	A manually operated battery master switch, which may be combined with the 'Engine/Motor/Drive start' switch, must be provided on the driver's instrument panel, but retain power to essential safety systems such as park brake warning interlocks, fire warning systems, hazard lights .		
50.46	A 600amp Bus booster socket (part number 6.008.25) or similar interchangeable connector must be fitted, but not on the right-hand side of the Bus for safety reasons. The preferred position is in the dashboard riser.		
50.47	The main electrical box shall be installed inside the Bus with easy access for inspection and component replacement.		
50.48	The provision of each individual circuit shall be protected by fuses or circuit breakers to prevent overloading.		
50.49	For reverse polarity protection, fast fuse or equivalent devices are required.		
50.50	The digital output pulse signal of speedometer shall have sufficient signal strength to be used by other on board systems, or be supplied by multiple sources. Refer Section 19 and Appendix 4.		

50.51	The system shall either have a high amperage isolator to cut off the main supply from the battery or be fitted with an isolator switch control.	
50.52	The electrical system shall 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.	
50.53	All electrical equipment must conform to the requirements of the Australian Communications and Media Authority's (ACMA) electromagnetic compatibility (EMC) regulation: Radio Communications (Electromagnetic Compatibility) Standard and UN ECE Reg 10 Rev 6. This is to reduce the potential to unintentionally emit radio frequency energy which may diminish the performance of other nearby electrical devices or disrupt essential communications.	
50.54	All electric and electronic functions of vehicles, which could affect safe operation of the vehicle, shall be functionally tolerant of the electromagnetic environments to which the vehicle will normally be exposed. This includes fluctuating voltage and load conditions and electric transients.	
50.55	The vehicle shall be tested to the appropriate parts of ISO 11451. The reference field strength shall be according to standards but shall be at least 30V/m.	
50.56	OEMs must comply with applicable limits for the protection against human exposure to electric and magnetic fields (EMF) in the low frequency range of the electromagnetic spectrum (ICNIRP Guidelines, 2010).	
50.57	OEMs must comply with applicable limits for the protection against human exposure to radio frequency fields (RF) in the frequency range 3 KHz to 300 GHz (Radiation Protection Series Publication No. 3, 2016).	
50.58	Operator nominated two-way radio equipment is to be supplied from a TfNSW list of approved radio suppliers at the retail prices nominated in that list, as arranged by TfNSW with the radio supplier and in consultation with the Operators. No details or price information for the supply of the radio is required for this RFP, as the final price will be adjusted depending on the radio selected.	
50.59	Provision of bracketry, and wiring is required for the two-way radio equipment at 50.54.	
50.60	Installation for the two-way radio equipment nominated at 50.54.	
50.61	Wire and install an AM/FM radio with minimum 4 x 20W outputs (RH and LH for the driver and separate RH and LH channel for the passengers).with 8 x 8Ω speakers. AM/FM radio is not required for State Transit however 8 x speakers for on-board Customer Communication System is required.	
50.62	Electronic ticketing wiring provisions are to be installed as detailed in Section 19 and Appendix 4.	

50.63	All components and harnesses must be standardised in design to allow interchangeability between Buses for a Bus Type.	
50.64	Electric plugs on harnesses are to be designed to prevent their incorrect installation using varying sizes and shapes enhanced by colour-coding. (poka –yoke).	
50.65	Soldered cable connections to components are not permitted.	
50.66	Connections are to be connected to components using post terminals or where appropriate, push-on terminals, conforming with a relevant international automotive standard such as SAE J163, SAE J858, SAE J561 and SAE J928.	
50.67	To enable repairs to terminals to be effected at minimal cost, sufficient cable length is to be provided to allow at least two terminal replacements.	
50.68	All terminal posts shall be mounted to prevent accidental shorting by conductive items falling on them	
50.69	Positive terminal posts must be protected with an appropriate insulation to protect from accidental shorting during maintenance.	
50.70	All terminal posts shall be assembled without intervening nuts, washers or spacers.	
50.71	Termination of more than four (4) cables at any single terminal is not permitted	
50.72	It is preferred cables are to be joined at terminals. Cables joined within a cable run must be in accordance with SAE J1292 Automobile and Motor Coach Wiring specification.	
50.73	Terminal boxes shall be arranged such that any water collecting in conduits or channels does not drain into the terminal box.	
50.74	A connection diagram shall be provided at each terminal box	
50.75	During manufacturing of the Bus body, any electrical components including cabling shall be removed if stray currents or welding spatter during welding could damage those components.	
50.76	During manufacturing of the Bus body, all cables, electronic control units, electronic instruments, batteries, electronic components removed from the chassis, must be individually labelled with part identifier and Bus build number or VIN identifier and stored in purpose designed storage boxes marked with the corresponding Bus build number or VIN identifier. The boxes must be stored in a controlled inventory area.	

50.77	During manufacturing of the bus, any component or part of the chassis must be protected by mats, weld curtains, weld spatter cloths or other suitable means to protect the entire chassis and components remaining on the chassis during build phase from damage.		
50.78	All swarf, grinding materials, off-cuts and debris shall be removed from cable trays, air conditioning ducts and cable conduits, prior to reassembly of components and cables.		
50.79	Fire-retardant, non-conductive, non-corrosive fastenings shall be used at the start and finish of any bend in a cable run to ensure the cable does not droop in a fire.		
51. FLOOR, STEP AND FLOOR EDGES			
51.1	The floor must be covered in a material which is, slip resistant and durable.		
51.2	The floor colour shall be as specified in Section 15.		
51.3	All flooring covering joints must be welded and or fully sealed to prevent water ingress.		
51.4	The front entry non-standing area to the point no further forward than the rearmost point of the driver's partition must be covered in a contrasting colour specified in Section 15.		
51.5	The same contrasting colour specified above must also be used in the Centre/Rear door non-standing area.		
51.6	If plywood is used for the floor structure it shall be:		
	51.6.1	structural marine grade ply in accordance with AS2272 or BS1088;	
	51.6.2	preservative treated to Class H3 in accordance with AS 1604; and	
	51.6.3	meet structural grade F14 (working stress 14MPa).	
51.7	The floor structure material shall be fit for the intended life of 25 years for the intended operational service of the bus. Details to be provided at Section 55.		
51.8	The front entry floor area must have a set of 70 mm high yellow 'No Standing Area' lettering inlaid or appropriate signage.		
51.9	Painted lettering is not accepted.		
51.10	The Centre/Rear door floor area must have a set of 70 mm high yellow 'No Standing Area' lettering inlaid or appropriate signage.		
51.11	Painted lettering is not acceptable.		

51.12	The floor structure and flooring material must be impervious to moisture penetration.	
51.13	The floor profile must be designed to eliminate pooling of water when the Bus is parked on a level surface.	
51.14	The floor covering must continue up the sides of the Bus as far as the underside of the body side seat rails.	
51.15	Sharp corners, both horizontal and vertical, must be avoided.	
52. ON BOARD SYSTEMS INTEGRATION & COMMUNICATION		
In addition to the mandatory integration and communication requirements of the Passenger Information Display Section 38, TfNSW is seeking proposals to further integrate the Supplier provided on-board systems and enhanced communications to allow large amounts of data to be retrieved from the Bus and information to be sent to the bus. The system is to interface with:		
52.1	CCTV (Section 36);	
52.2	Destination Equipment (Section 35);	
52.3	Passenger Information Display (Section 38);	
52.4	Bus Chassis CAN systems, and Multiplexed vehicle systems;	
52.5	Engine Bay Fire Suppression Systems (EBFSS) Section 12.	
52.5	Electronic Ticketing System (ETS) Section 19; and	
52.6	The system is to send the status of any of the interfaced items to the PASSENGER INFORMATION DISPLAY (PID) SYSTEM.	
52.7	Items on the initial PID list include: Centre/Rear Door Closing, Wheelchair ramp deployed, and scrolling CCTV camera views.	
52.8	Remote Communication is to be provided using an on-board SIM and the 5G network with sufficient capacity to:	
52.9	send the status of any of the interfaced items to a remote location;	
52.10	Items on the initial remote list include: EBFSS status, Bus location, duress alarm, and Bus speed;.	

52.11	provide live streaming from the CCTV system to a remote location; and		
52.12	provide “push-to-talk” communications with other buses within the same Bus fleet or back to base to computer terminal using software rather than radio.		
52.13	A sleeping child safety system shall be provided which requires the driver to walk to the back of the bus when the bus is turned off. The system details are as follows:		
	52.13.1	The alarm must be an audible alarm that is hard wired into the vehicle where it must activate when the engine ignition switch is turned off.	
	52.13.2	The alarm disabling switch must be located inside and at the rear of the vehicle in such a position that it requires the driver to walk along the aisle to the rear of the vehicle to activate the alarm disabling switch.	
	52.13.3	There may be a delay of up to 30 seconds before the alarm sounds in order to provide time to conduct an inspection and disable the alarm.	
	52.13.4	The audible alarm can be either the vehicle horn or sound emitted from the child alarm.	
	52.13.5	The audible alarm must be loud enough for a person to hear it from a distance of up to 10 metres and should, as a minimum, emit 95 decibels.	
	52.13.6	The operating procedure for the child alarm must be affixed as a decal in a location which is clearly visible by the driver to enable the driver to deactivate the alarm system.	
	52.13.7	Child alarms such as a Doran Sleeping Child Check Monitor or Ashley Group Child Alarm are considered suitable.	
52.14	Installation and commissioning of the TCB Consat Telematics solution as prescribed in the document in Appendix 12.		
52.15	The bus shall be fitted with the latest common standard of FMS output compatible with European manufacturers to allow bus systems to obtain information in a standard format.		
53. SPARE PARTS			

53.1	Chassis and body spare parts must be generally available ex-stock within 24 hours to any site in the purchaser's operating area.	
53.2	Copies of the Bus catalogue of spare parts must be made available to the principal of the Deed where required.	
53.3	The catalogue must include part description and part number. Any updates to the catalogue must be made available upon request.	
54. SERVICING AND TRAINING		
54.1	The Supplier must provide suitable and sufficient service and repair facilities 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.	
54.2	The Supplier must provide detailed service and maintenance instructions for the Bus to ensure the Operator can perform correct service and maintenance as per procedures set out by the manufacturer and any componentry sub- supplier. This information includes all Fire Mitigation process and procedures as they relate to ongoing maintenance, servicing, cleaning, upkeep and component change out programs.	
54.3	During the warranty periods, the supplier 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.	
54.4	Full service, maintenance and workshop information, and spare parts lists, must be provided by the supplier before the first Bus is delivered (to the Bus operator). All information, manuals and drawings must be written in the English language.	
54.5	Provide the Bus operator and TfNSW 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 supplier to enable the operator to operate and maintain the Buses in accordance with the supplier's guidelines. These documents must be provided in a manner that is auditable and understood by both the operator and supplier. Documentation must be provided in hard and or soft copy.	
55. BUS TYPE APPROVAL DESIGN REVIEW		
As part of the evaluation, a Bus Type Approval Design Review will be conducted to determine if the Bus complies with the Specification. All documentation must be provided in electronic Excel, Word or PDF documents, or information provided via Supplier's portal. No hard copies are to be provided.		

55.1	Supplier shall provide a general arrangement drawing, showing the key dimensions of the Bus including overhangs, wheel base, overall length, width, height, door dimensions, ground clearances (Refer ADR 43/04, ADR58/00).	
55.2	Supplier shall provide a drawing showing the location and size of the emergency exits, including foot holes, and roof hatches for the bus. (Refer ADR 44/02).	
55.3	Supplier shall provide a general arrangement drawing in plan and elevation, showing the seating layout for each of the seat types offered. (Refer ADR 58/00, TS148, ADR68/00)	
55.4	For each variant offered, Supplier to provide weight distribution forms with a diagram detailing driver and passenger seat locations, standing areas, battery location and luggage areas. Bus to be Fully Laden.	
55.5	Supplier shall provide a drawing showing the Exterior Lighting with dimensions to demonstrate compliance with the lighting ADRs. (Refer ADR 13/00).	
55.6	Supplier to provide drawing of hearing augmentation loop installation providing 100% coverage of the total area of the enclosed internal passenger space of the Bus.	
55.7	The supplier must provide evidence that recognised design and evaluation techniques, such as finite element analysis (FEA), have been used in the design of the body frame.	
55.8	The Supplier must provide an ADR compliance summary for each variant of bus, including Component Registration Numbers (CRNs) and relevant report numbers for supporting information, and the chassis SARN (Sub Assembly Registration Number) or Secure Vehicle Identification Marking (SVIM) for each variant.	
55.9	The Supplier must provide a DDA compliance summary for each variant of bus. The DDA compliance summary will list how the Bus complies with all relevant requirements of the Disability Standards for Accessible Public Transport 2002 and associated standards.	
55.10	Chassis repair and workshop manual;	
55.11	Body repair and workshop manual including paint codes and	
55.12	All proprietary equipment manuals (e.g. destination equipment, air conditioning, radio, door systems, etc.);	
55.13	a full set of electrical wiring diagrams for both chassis and body;	
55.14	a full set of pneumatic circuit diagrams for both chassis and body	
55.15	a full set of hydraulic circuit diagrams	

55.16	an electronic system integration and architecture manual detailing system break points defining segregation between the equipment supplied	
55.17	an electrical load schedule indicating ampere draw of each item.	
55.18	For the purpose of evaluation, access to review electronic diagnostic software and maintenance systems used to support the Bus.	
55.19	Supplier shall supply its standard schematics showing the Passenger Information Display installation and wiring	
55.20	Suppliers shall provide details on how the fire rating of the engine and wheel well areas were determined as per clauses 11.19 and 11.36.	
55.21	Supplier shall provide a general arrangement drawing of the paint scheme for each Bus type offered. Refer Section 14 for livery standard.	
55.22	Supplier shall supply Quality Assurance Certification for the complete Bus and chassis sub-assembly manufacturing facilities referred to in Section 7.	
55.23	Supplier shall supply its standard schematics showing the radio installation and wiring. NB: Radio systems are Operator dependent and Suppliers are to modify and record any configuration changes for each Operator.	
55.24	Supplier shall supply its standard schematics showing the duress alarm / OCC amplifier installation and wiring. NB: Duress / OCC Amplifier installations are Operator dependent and Suppliers are to modify and record any configuration changes for each Operator.	
55.25	Supplier shall supply its standard schematics showing the ticketing system installation and wiring.	
55.26	Supplier shall supply its standard schematics showing the air conditioning installation and wiring. NB: Air conditioning systems are usually sub-supplier dependent and Suppliers are to modify and record any configuration changes for each Operator.	
55.27	Supplier shall supply its standard schematics showing the fire suppression and tyre pressure monitoring installation and wiring. NB: These systems are usually sub-supplier dependent and Suppliers are to modify and record any configuration changes for each Operator.	
55.28	Supplier shall supply its standard schematics showing the CCTV installation and wiring as detailed in Section 36 . NB: CCTV systems are usually Operator dependent (based on risk) and Suppliers are to modify and record any configuration changes for each Operator.	
55.29	The Supplier must provide evidence that the Bus is designed, constructed and commissioned such that it satisfies the Fire Risk Management and Fire Risk Reduction requirements of AS 5062-2016.	
55.30	The Supplier provide evidence that it has considered the information contained in the Bus Industry Confederation (BIC) Fire Mitigation Advisory, published in 2014 in its design.	

55.31	Supplier shall supply its standard schematics showing any ancillary equipment such as fuelling, door actuation or any other systems fitted by the Supplier on behalf of Operators.		
55.32	Details of the floor structure material used and the properties associated with those materials shall be provided.		
55.33	For rollover ADR59/00, certification that the superstructure meets or is not required to meet the standards for rollover strength.		
55.34	For buses with ADR68/00 seats, certification that the seats and modesty panels meet ADR68/00 and the floor structure meets the strength requirements of ADR68/00.		
55.35	The Supplier shall supply details of the the materials, such as: C3R12 stainless steel; 304 stainless steel; galvanised steel or 6000 series aluminium alloy, that are used in the Bus frame, chassis extension, wheel arches, steps and floor support framework.		
55.36	The Supplier shall supply the quality assurance processes used to demonstrate manufacturing compliance for body frame welded or bolted joints.		
55.37	To demonstrate the Supplier's Engineering Management Capability, suppliers are to **briefly** describe how it meets the following requirements in a separate document titled Supplier's Engineering Management Capability.		
	55.37.1	The Supplier shall outline its engineering and management capability to provide support during procurement, manufacturing, construction, integration, testing, commissioning, and maintenance stages of the bus life cycle.	
	55.37.2	The Supplier shall provide details of its management system used to ensure the bus specifications' requirements are addressed by appropriate processes, allocation of responsibilities and stating deliverables.	
	55.37.3	The Supplier shall demonstrate the capability to trace the performance of the bus in meeting the specifications' requirements throughout the life cycle of the bus.	
	55.37.4	The Supplier shall outline its capability to design, develop and support complete Buses in accordance with global industry best practice.	
	55.37.5	The Supplier shall detail its interface management capabilities in relation to the design and version control of the various electronic sub-system interfaces such as the chassis CAN, body multiplexing, electronic ticketing, destination and various safety systems.	

55.37.6	The Supplier shall detail its capability to plan and carry out the integration of all the bus sub-systems to ensure the safety and reliability performance of the Bus during its life. Such sub-systems include chassis, body, air-conditioning systems, door systems, hand brake warning systems and fire safety systems.	
55.37.7	The Supplier shall demonstrate, by an example, that it has the capability to develop a framework architecture used for detailed system design.	
55.37.8	The Supplier shall detail its “cradle-to-grave” design considerations in the Bus design to meet the environmental, social and economic aspects of sustainability. This includes the potential to recycle and re-use components and the disposal considerations at the economic life end.	
55.37.9	The Supplier shall detail its arrangements in place to ensure that Reliability, Availability and Maintainability (RAM) properties of the Buses are achieved.	
55.37.10	The Supplier shall incorporate relevant human factors design in the development of the buses to ensure passengers, drivers, mechanics and other people coming in contact with the bus are safe and comfortable.	
55.37.11	The Supplier shall detail how it validates how its Buses meet the statutory, and design standards required.	
55.37.12	The Supplier shall describe its engineering and production quality assurance processes, which may use such techniques such as gateway reviews or quality gates.	
55.37.13	The Supplier shall provide details of its risk-based approach to engineering systems assurance in design and in running changes.	
55.37.14	The Supplier shall detail its system safety assurance process that describes how it has mitigated safety risks So Far As Is Reasonably Practical (SFAIRP).	
55.37.15	It shall also support risk-based decision-making with records to show traceability of all decisions made.	
55.37.16	The Supplier shall provide fire assurance reports for each bus type.	
55.37.17	The Supplier shall describe their configuration management system that is suitably aligned with ISO 10007 – Quality Management – Guidelines for Configuration. This shall cover the complete Bus including suppliers and sub-	

	55.37.18	The Supplier shall have comprehensive documented system for managing the qualifications and competence of its staff and third party suppliers, relevant to the scope of work of this Deed.	
	55.37.19	The Supplier shall detail its methods to identify the training and development needs for staff delivering the contracted engineering services.	
	55.37.20	The Supplier shall have demonstrated and documented system in place to manage selection, acquisition, evaluation and monitoring of products and services delivered by internal and external suppliers over the contract life cycle.	
	55.37.21	The Supplier shall have demonstrated and documented system in place for continual and systematic process improvement based on the company measured processes improvement KPIs and the bus systems performance over the assets life cycle.	
55.38	For all the component options offered in Section 2, provide the manufacturers specification sheets for each unique option. Provide as a single package.		
55.39	For Buses made from black steel, the Supplier must provide a detailed descripton of the corrosion protection provided.		
55.40	ADAS details, certification documents and training package		
55.41	OEMs shall provide an Environmental Product Declaration (EPD), that includes reporting on embodied and operational energy and carbon. The embodied carbon and understanding of the sustainability of materials will be a key consideration in procurement, where meeting net zero targets for the supply chain must be measurable and assured in the future. To be pursued in sustainability stream.		
56.	**BUS TYPE APPROVAL – SPECIFICATION TESTS AND FULLY LADEN TESTING**		
As part of the evaluation, Bus Type Approval Testing may be conducted on a sample of a Bus type to determine if the Bus complies with this complete Specification. Buses undergoing this test will have reached acceptable desk-top compliance with the specification.To demonstrate laden performance, the Supplier is to also to provide a fully laden Bus (with weigh bridge ticket to conform weights) and driver to conduct the following tests:			
56.1	Acceleration performance	Refer 5.3	
56.2	Gear up smooth changes fully laden	Refer 5.5	

56.3	Gear down smooth changes fully laden	Refer 5.5	
56.4	Handbrake and stop start test fully laden	Refer 5.6	
56.5	Road speed limiter and top speed fully laden	Refer 5.7	
56.6	Engine/transmission noise level at rear 5 seat, Engine/Motor/Drive idle, fully laden.	Refer 5.9	
56.7	Engine/transmission noise level at rear 5 seat, full throttle, fully laden	Refer 5.9	
56.8	L_{eq} (one hour)	Refer 5.9	
56.9	Door brake pre-set speed	Refer 20.2	
56.10	Door brake retardation fully laden	Refer 20.3	
57. WHOLE OF LIFE COSTS			
To assess the whole of life costs for the bus, Suppliers must provide the following information for evaluation. :			
57.1	Appendix 7A (Diesel Bus) and 7B (Zero emission Bus ZEB) and Appendix 8 contains templates which list the major components used in the life of the Bus for the chassis and the body as appropriate. Suppliers are to provide the service life and the hours required to effect the replacement or overhaul as indicated.		
57.2	For the purpose of evaluation, the annual distance travelled is standardised to 50,000 km per year.		
57.3	Where the service life is for the 25 year life of the bus, 1,250,000 km, set the service life to (25 years x 50,000 km).		
57.4	The Supplier must provide fuel consumption figures in accordance with UITP SORT TEST 1, 2, and 3 for the chassis and expected similar Bus body configuration.		
57.5	As an alternative to 57.4, energy consumption results from standardised on-road test cycles performed by a third party shall be provided. Tests shall be conducted under agreed normal conditions at a nominated representative location.		
57.6	In addition to the information provided in Appendix 7, Supplier must provide details of the work that is expected for the Engine/Motor/Drive overhaul, the components and materials that are expected to be replaced and the associated hours expected to complete the overhaul.		

57.7	In addition to the information provided in Appendix 7, Supplier must provide details of the work that is expected for the transmission overhaul, the components and materials that are expected to be replaced and the associated hours expected to complete the overhaul.	
57.8	a chassis specific maintenance service schedule nominating parts required and estimated labour hours.	
57.9	a body specific maintenance service schedule nominating parts and estimated labour hours.	
58. PRE- DELIVERY BUS TESTING AND ACCEPTANCE		
Prior to the delivery of each bus, Bus Operators will conduct a Pre-Delivery Inspection with the Supplier in accordance with the template in Appendix 9.		
58.1	Bus to be fueled/charged to at least 25% of its full rated capacity .	
58.2	Bus batteries to be fully charged.	
58.3	Documentation and certification plates provided in accordance with Section 59.	
58.4	Pre-Delivery inspections and road tests as per Appendix 9 will be conducted by the TfNSW Contracted Bus Operator with the Supplier.	
58.5	The Purchaser may, prior to signing for acceptance of each bus, test, examine, measure or take such other action as is necessary to determine whether the Bus is in accordance with this Specification and any other mutually agreed documentation considered and agreed as appropriate between the Bus Operator and the Supplier, which will include but not limited to; ADR, DDA, Service NSW TS, and the Standards set out for Fire Mitigation compliances.	
59. PRE-DELIVERY DOCUMENTS / PLATES REQUIRED		
At the Pre-Delivery Inspection the following documents and certifications must be provided by the Supplier:		
59.1	Weigh bridge ticket detailing Bus VIN and individual axle masses provided by Supplier for each Bus	
59.2	Wheel alignment figures provided by Supplier for each bus	
59.3	Certification plate: TS147 - Field of view of the passenger entrance doors of a bus	
59.4	Certification plate: TS148 - Padding for seatback, hand rails and partitions on buses.	

59.5	Certification plate: TS150 – Warning signs and lights for school buses.	
59.6	Certification plate: TS160 - Bus door safety systems.	
59.7	NSW Registration plates front and rear	
59.8	NSW Registration papers	
59.9	Manufacturer's Compliance plate fitted or evidence of ROVER approval.	
59.10	Chassis SARN plate fitted, or Secure Vehicle Identification Marking (SVIM).	
59.11	Pre-delivery chassis completed and signed	
59.12	Pre-delivery body completed and signed	
59.13	Pre-delivery air conditioning completed and signed air–conditioning commissioning document	
59.14	Pre-delivery destination signs completed and signed	
59.15	Pre-delivery transmission completed and signed	
59.16	Pre-delivery door certification completed and signed.	
59.17	Fire suppression (EBFSS) commissioning report.	
59.18	Tyre Pressure Monitoring (TPMS) commisioning report	
59.19	Electronic Ticketing System commissioning document	
60. SCHEDULE OF KEYS TO BE SUPPLIED		
At the Pre-Delivery Inspection the following keys must be provided by the Supplier:		
60.1	Ignition key	
60.1	Body access keys	

60.2	Budget lock key		
60.3	Driver's locker key		
60.4	Retarder key and barrel		
60.5	Security keys		
61. OPTIONS			
The Following options for Buses following business case approval to TfNSW by individual operator.			
61.1	Single leaf door at the Centre/Rear Door, minimum clear width of 850mm.		
61.2	USB charge points at seat base or other approved location as set out in a drawing provided by Supplier.		
61.3	Integrated Fleet Management System, with main parameters not limited to:		
	61.3.1	Driver performance;	
	61.3.2	Vehicle performance;	
	61.3.3	Data logging for vehicle operating parameters;	
	61.3.4	Accident analysis capabilities;	
	61.3.5	Download and upload through wireless or cable link;	
	61.3.6	Security features; and	
	61.3.7	Software compatible to latest Microsoft Operating System.	
61.4	A3 Notice Board (snap lock) to rear of driver's compartment (operator's choice of portrait or landscape).		
61.5	Stainless steel backs on the 3 last rear seat rows.		
61.6	For articulated buses deletion of Rear Door.		
61.7	Door locks on the Front, Centre and Rear Doors		

61.8	Driver's broom clip.		
61.9	To allow the safe deployment of the portable fire extinguisher for fires in the rear Engine/Motor/Drive bay, an extinguisher port hole of approximate dimension 50 mm radius is to be provided in the Engine/Motor/Drive door centrally at a height of 1.0 m to 1.4 m from the ground or in accordance with the operator's requirements.		
61.10	Not used		
61.11	Split windscreen (two piece with vertical rail)		
61.12	Cantilever passenger seat frames as an option (Note: Complete bus set to be in Price Schedule).		
61.13	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 to150kg. The seat must be fitted with lap/sash seatbelt with the buckle on the left-hand side.		
61.14	A driver's security ¾ or Full Screen can be provided and shall be part of a driver's cabin door and shall open and close with the cabin door. The screen shall provide the driver with a degree of protection against passenger assault but without inhibiting the driver vision, access to passengers for collection of fares and issuing of tickets, or access to and from the cabin.		
61.15	Interior Decals and Exterior Logos as per Section 16.		
61.16	For emergency duress alarm, a 3rd hand switch near the right hand cabin wall		
61.17	For emergency duress alarm, integration with horn and headlight flashing functions.		
61.18	A transmission selector that enables gear holding in Drive in a particular gear, offered with 123RND configuration.		
61.19	Opening roof hatches fitted with "do not open - emergency only" decal and alarmed to warn driver hatch has been opened.		
61.20	A luggage pen complying with the following:		
	61.20.1	The design of the luggage pen must prevent small items from rolling out. The aisle face of the rack is to be lower than the surrounding rail to allow large items to be easily lifted out.	

	61.20.2	The design of the luggage pen must not intrude on circulation spaces to access the allocated spaces for wheelchairs.	
	61.20.3	Where luggage could come into contact with any windows, suitable protection bars must be fixed to the body side to prevent damage to the window.	
61.21	Vehicle Frontal Protection Systems (VFPS) or bull bars according to the following requirements:		
	61.21.1	Shall comply with the requirements AS 4876.1 - 2002 Motor vehicle frontal protection systems Part 1: Road user protection (except Clause 3.2, "Road user protection criterion"). It is acknowledged this standard applies for vehicles up to 3.5 tonnes, however TfNSW is applying this standard on Buses to reduce injury to any person.	
	61.21.2	Shall comply with the requirements of Bull bar tolerances and conditions - Technical Specification applicable in NSW during the exemption period (Extended until September 2019). It is acknowledged this Technical Specification applies for vehicles up to 3.5 tonnes, however TfNSW is applying this standard on Buses to reduce injury to any person.	
	61.21.3	The maximum allowable overall length of the bus shall not be exceeded due to the fitment of the VFPS. (ADR43/04)	
	61.21.4	The bull bar mass shall be accounted for in the Unladed and Fully Laden Mass for the Bus and hence the passenger capacity calculations for the Bus.	
	61.21.5	The bull bar shall: be fitted to follow the Plan view profile of the Bus to prevent hooking of pedestrians;	
	61.21.6	be designed , built and fitted to the Bus in a way that minimises the likelihood of injury to a person making contact with the bus (refer ADR42/05) ;	
	61.21.7	have edges which are de-burred and rounded, with a minimum radius of 5mm;	
	61.21.8	have no open-ended sections;	
	61.21.9	not slope forward more than 9° or have an offset of more than 75mm;	
	61.21.10	have accessory brackets which do not project forward of the bull bar;	

	61.21.11	not project wider than the width of the bus;	
	61.21.12	not obscure the front number plate (entire plate to be visible from 20 metres at an arc of 45° above and to the left and right hand side of the plate);	
	61.21.13	not reduce the approach angle defined in this specification;	
	61.21.14	not obscure any lights breaching the lighting rules including : ADR13/00, ADR6/00, ADR46/00 and ADR 49/00; and	
	61.21.15	not interfere with the field of view of the driver.	
61.22	Deletion of metro seats and replaced by ADR 68/00 seatbelted seats		
61.23	Deletion of ADR68/00 seat belted seats and replace by metro seats		
61.24	ETS ticketing as per Section 19.		
61.25	Rubber-mounted glazing as an alternative to direct bonded glazing		
61.26	An Advanced Driver Assist System (ADAS) with the following requirements:		
	61.26.1	Headway Monitoring and tailgate Warning shall provide visual time to collision with vehicles in front of bus and warns audibly and visually when this becomes less than 3 seconds.	
	61.26.2	Forward Collision Warning shall provide the driver with visual and adible warning of imminent collision up to 2.7 seconds ahead.	
	61.26.3	Pedestrian and Cyclist collision Warning: provides visual and audible warning of time to collision up to 2 seconds ahead, and provide limitations of when this system is active(such as in poor light conditions). It is preferable the detection system can operate in poor light conditions.	
	61.26.4	Lane Departure Warning shall provide visual and audible warning and to be active above 55km/hr.	
	61.26.5	The console and camera shall be mounted in a tamper proof housing and conduit to prevent drivers or passengers switching the unit off, damaging wiring or adjusting the unit settings.	

	61.26.6	Signoff by the chassis manufacturer shall be provided to confirm the system does not adversely affect the vehicle or warranties.	
	61.26.7	Details of any alteration to the system for specific bus models, such as special cables to replace exsiting CAN cables, to be provided in full and included in the cost of the system.	
	61.26.8	A suitable training package shall be provided for each Operator so their trainers can deliver training to drivers.	
	61.26.9	The system shall have the capability to record activation history for analysis.	
	61.26.10	Local service and support shall be provided to ensure the system is tuned to suit the operating environment of the Operator and the system is supported.	
61.27	Lift up wheel arch panels fitted with South Co Locks		
61.28	Fit brackets and wiring for customers ticket machine		
61.29	An allocated space for a customer cash box provided within the driver's cabin area		
61.30	Child check system - There are systems that require the driver to walk to the back of the bus to turn off an alarm at the end of his shift. This prevents a small child being left on the bus		
61.31	HEPA filters for AC systems - Increase the quality of the air filter in the AC to reduce the spread of air borne infections		
61.32	Luggage bin blower motor		
61.33	"Fasten Seatbelt" sign for seatbelted buses.		
61.34	Windscreen protector		
61.35	Rear stone guard under engine bay		

61.36	In addition to the charging equipment at 39B.1.25, a set of pantograph charging rails in the roof is required as an option to suit a down ward (inverted)pantograph:		
	61.36.1	The communication protocal used for the pantograph charger must be compatible with the CCS2 DC plug in charger.	
	61.36.2	Comprehensive details of the pantograph arrangement and associated compatible charging equipment proposed by the Supplier are to be provided.	
	61.36.3	The details of special batteries proposed for fast charging, under a pantograph arrangement are to be clearly marked " PANTOGRAPH FAST CHARGE". *Note: fast charging is typically where the C rating is >0.8C (75 minutes charging time or less) and the power output of the charger is 300kW to 600kW.*	
	61.36.4	If buses are ordered with optional pantograph charging provisions, these charging provisions shall be supplied in accordance with TS 00089:10 - Battery Electric Buses - Charging Interoperability (2023) and this is in addition to vehicle inlet charging requirements in this Specification.	
	61.36.5	To be clear, pantograph charging provisions shall not replace vehicle inlet charging requirements.	
	61.36.6	All bus pantograph charging systems shall comply with the EMC requirements of IEC 61851–21–2	
	61.36.7	The bus pantograph charging system shall comply with the communication requirements and charging control process in AS IEC 61851,23, AS IEC 61851 24 and ISO 15118 (all parts).	
	61.36.8	To reduce the bus weight and complexity, the pantograph type shall be top-down type with pantograph lowered from fixed infrastructure to the contact rails located on the bus.	
	61.36.9	For information, the pantograph (not provided by the bus supplier) will be fail-safe and retract to a safe position in failure mode, including loss of power, to	
	61.36.10	The pantograph charging system shall be able to be supplied by multiple suppliers using common specifications such as ‘OppCharge’ or a similar specification	

	61.36.11	The pantograph connector shall provide a device to enable the galvanic connection of the vehicle electrical chassis to the earth ground of the external power supply of the charging pantograph.	
	61.36.12	The pantograph charging system shall enable connection to the earth ground before exterior voltage is applied to the vehicle and retain the connection until after the exterior voltage is removed from the vehicle.	
	61.36.13	Bus contact rails shall be located in positions which are common across all bus types (such as on the roof, directly above the front axle) to allow a standard guidance system for placing buses in the correct parking slot for charging.	
	61.36.14	maximum charging characterises to achieve the REESS warranty conditions and REESS design life shall be considered.	
	61.36.15	Pantograph interface design shall consider imperfect parking conditions such as buses parked at an angle or buses on a slight lean.	
	61.36.16	The on-board power supply circuits shall meet ISO 17409 safety requirements.	
	61.36.17	The Supplier shall provide documentation which confirms compliance with these requirements to both the TfNSW contract representative and the bus operator.	
	61.36.18	The Supplier shall confirm that they have provided compliance documentation (refer 61.36.17) prior to acceptance of a bus during the handover process.	
	61.36.19	The handover process shall include confirmation that the bus charging system is compatible with the depot charger systems at the destination bus depot by charging the bus.	
	61.36.20	Suppliers are reminded to provide pricing for item 61.36 in Returnable Schedule 5.	
61.37	as an Option choice by bus operators, Aboriginal Artwork decal wrapping to be applied to rear of bus sides and rear of bus and funded by TfNSW based on TFNSW Standard Brand Design and as arranged by TfNSW with supply to decal suppliers. No price information for the supply of artwork is require for this RFP, as the final price will be adjusted within the TfNSW Bus Website Portal for category of bus. Refer intended design APPENDIX 13.		
61.38	Bus Operator can have the option of retaining the existing company livery requirements (instead of the standard of TfNSW Standard Chevron Livery) and arranged by the bus operator with the Bus Prime supplier at no additional cost to the TfNSW.		

61.39	Not used		
61.40	Not used		
61.41	Not used		
62. ARTICULATED ASSEMBLY			
62.1	For Articulated Buses, the articulated joint:		
	62.1.1	body structure must be designed and warranted in accordance with the bus body structural requirements and verified as per this Specification.	
	62.1.2	body structure must be designed and warranted in accordance with the bus body corrosion requirements and verified as per this Specification.	
	62.1.3	must have sufficient articulation in the joints to allow the bus to operate bus services in the Operating Environment and Operating Requirements as per this	
	62.1.4	must have systems for limiting engine/motor power at high articulation angles to maintain traction and prevent jack-knifing.	
	62.1.5	summary of the system used for limiting engine /motor power is to be provided in the comments column.	
	62.1.6	bounce, jounce and undulation due to dynamic responses in service is to be controlled so it does not present discomfort to passengers or affect the driveability of the bus.	
	62.1.7	summary of the system used for controlling dynamic responses is to be provided in the comments column.	
	62.1.8	must be easily inspected and serviced without the need for deconstruction to inspect.	
	62.1.9	must have lubrication a centrally located lubrication point	
	62.1.10	must not be noisy in operation	

	62.1.11	summary of maker and model to be provided in comments	
62.2	For Articulated Buses, the turntable area must:		
	62.2.1	Provide an even surface which does not present a trip hazard to passengers.	
	62.2.2	Be provided with suitable handrails	
	62.2.3	Have no entrapment or pinch points for passengers	
62.3	For Articulated Buses the bellows curtains:		
	62.3.1	must be of design an materials which are durable and easy to clean.	
	62.3.2	must be easy to service and replace.	
	62.3.3	summary of maker and model to be provided in comments	

63. REFERENCES

The Following references were used in this specification:

63.1	Motor Vehicle Standards Act 1989
63.2	Heavy Vehicle (Mass , Dimension and Loading) National Regulation
63.3	Disability Discrimination Act 1992
63.4	Disability Standards for Accessible Public Transport 2002
63.5	Australian Standard AS1428.1-2001 Design for access and mobility – General requirements for access – new building work

63.6	Australian Standard AS1428.2-1992 Design for access and mobility – Enhanced and additional requirements – Buildings and facilities
63.7	Australian Standard AS 3856.1-1998 Hoists and ramps for people with disabilities- Vehicle mounted –Product Requirements
63.8	Australian Standard AS 3856.2-1998 Hoists and ramps for people with disabilities- Vehicle mounted –Installation Requirements
63.9	Australian Standard AS 5062 -2016 Fire protection for mobile and transportable equipment
63.10	Swedish SPCR 183 Certification Rules regarding Fire Suppression Systems in Engine Compartments of buses and coaches
63.11	British Standard BS 476: Part 7:1997 Fire tests on building materials and structures – Part 7 – Method of test to determine the classification of the surface spread of flame of products.
63.12	British Standard BS 5852:2006 Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources (Crib 7)
63.13	European Standard ECE/324, Regulation 118, Uniform technical prescriptions concerning the burning behaviour and/or the capability to repel fuel or lubricant materials used in the construction of certain categories of motor vehicle.
63.14	Australian Standard AS 1530.4 – 2005 Methods for fire tests on building materials, components and structures Part 4: Fire-resistance test of elements of construction.
63.15	Australian Standard AS 2444 – 2001 Portable Fire Extinguishers and Fire Blankets – Selection and Location
63.16	European Standard ECE/324, Regulation 107, Uniform Provisions Concerning the Approval of Category M_2 or M_3 Vehicles with regard to their General Construction
63.17	Road Transport (Vehicle Registration) Regulation 2017 NSW
63.18	Vehicle Standard (Australian Design Rule Definitions and Vehicle Categories) 2005
63.19	Vehicle Standard (Australian Design Rule 1/00 – Reversing Lamps) 1991
63.20	Vehicle Standard (Australian Design Rule 3/03 – Seats and Seat Anchorages) 2008
63.21	Vehicle Standard (Australian Design Rule 4/04 – Seatbelts) 2008
63.22	Vehicle Standard (Australian Design Rule 5/05 – Anchorages for Seatbelts) 2008

63.23	Vehicle Standard (Australian Design Rule 5/05 – Anchorages for Seatbelts) 2008
63.24	Vehicle Standard (Australian Design Rule 6/00 – Direction Indicators) 1991
63.25	Vehicle Standard (Australian Design Rule 8/01 – Safety Glazing Materials) 1994
63.26	Vehicle Standard (Australian Design Rule 14/02 – Rear Vision Mirrors) 1993
63.27	Vehicle Standard (Australian Design Rule 14/02 – Rear Vision Mirrors) 1993
63.28	Vehicle Standard (Australian Design Rule 18/03 – Instrumentation) 2006
63.29	Vehicle Standard (Australian Design Rule 35/03 – Commercial Vehicle Brake Systems) 2011
63.30	Vehicle Standard (Australian Design Rule 42/05 – General Safety Requirements) 2005
63.31	Vehicle Standard (Australian Design Rule 43/04 – Vehicle Configuration and Dimensions) 1998
63.32	Vehicle Standard (Australian Design Rule 43/04 – Vehicle Configuration and Dimensions) 1998
63.33	Vehicle Standard (Australian Design Rule 44/02 – Specific Purpose Vehicles) 1998
63.34	Vehicle Standard (Australian Design Rule 46/00 – Headlamps) 1991
63.35	Vehicle Standard (Australian Design Rule 47/00 – Retroreflectors) 1991
63.36	Vehicle Standard (Australian Design Rule 48/00 – Devices for Illumination of Rear Registration Plates) 1991
63.37	Vehicle Standard (Australian Design Rule 49/00 – Front and Rear Position (Side) Lamps, Stop Lamps and End-Outline Marker Lamps) 1991
63.38	Vehicle Standard (Australian Design Rule 58/00 – Requirements for Omnibuses Designed for Hire and Reward) 2006
63.39	Vehicle Standard (Australian Design Rule 61/02 – Vehicle Markings) 1995

63.40	Vehicle Standard (Australian Design Rule 65/00 – Maximum Road Speed Limiting for Heavy Goods Vehicles and Heavy Omnibuses) 1995
63.41	Vehicles Standard(Australian Design Rule 68/00 - Occupant Protection in Buses) 2006
63.42	Vehicle Standard (Australian Design Rule 74/00 – Side Marker Lamps) 2000
63.43	Vehicle Standard (Australian Design Rule 76/00 – Daytime Running Lamps) 2000
63.44	Vehicle Standard (Australian Design Rule 80/03 – Emission Control for Heavy Vehicles) 2010
63.45	Vehicle Standard (Australian Design Rule 83/00 – External Noise) 2005
63.46	AS 3791-1991 Hydraulic Hose
63.47	Society of Automotive Engineers, SAE J30: Fuel and Oil Hoses
63.48	Australian Standard AS 4506 – 2005 Metal finishing – Thermoset powder coatings
63.49	Australian Standard AS 4833 – 2007 Pressure sensitive labels for stock-paper, stock plastic and general purpose use
63.50	Australian Standard AS 1288-2006 Glass in buildings – Selection and installation
63.51	Australian Standard AS 1604-2010 Specification for preservative treatment
63.52	Australian Standard AS/NZS 1906.2:2007 (Retro-reflective Materials and Devices for Road Traffic Control)
63.53	Australian Standard AS 2272-2006 Plywood Marine
63.54	British Standard BS 1088-1:2003 Marine Plywood
63.55	ISO 6722:2006 Road vehicles – 60 V and 600 V single-core cables – Dimensions, test methods and requirements
63.56	Transport Asset Standards Authority T BU FL 01701 ST – Mounting and Installation of Electrical Equipment - DRAFT
63.57	Society of Automotive Engineers, SAE J1292: Automobile and Coach Wiring

63.58	Society of Automotive Engineers, SAE J156: Fusible Links
63.59	Society of Automotive Engineers, SAE J553: Circuit Breakers
63.60	Society of Automotive Engineers, SAE J163: Low Tension Wiring and Cable Terminals and Splice Clips
63.61	Society of Automotive Engineers, SAE J858: Electrical Terminals – Blade Type
63.62	Society of Automotive Engineers, SAE J561: Electric Terminals – Eyelet and Spade Type
63.63	Society of Automotive Engineers, SAE J928: Electric Terminals – Pin and Receptacle Type
63.64	Society of Automotive Engineers, SAE J1708: Serial Data Communications Between Microcomputer Systems in Heavy-Duty Vehicle Application 2016
63.65	Society of Automotive Engineers, SAE J1939: Recommended Practice for a Serial Control and Communications Vehicle Network 2018.
63.66	Roads and Maritime Services NSW Technical Specification Sheet TS147 – Field of view of the passenger entrance doors of a bus
63.67	Roads and Maritime Services NSW Technical Specification Sheet TS148 – Padding for seat backs handrails and partitions on buses
63.68	Roads and Maritime Services NSW Technical Specification Sheet TS150 – Warning signs and lights for school buses
63.69	Roads and Maritime Services NSW Technical Specification Sheet TS160 – Bus door safety systems
63.70	Transport Asset Standards Authority T MU TE 61003 ST – Public Address Systems 2015
63.71	BC/14-23562 (2018) SMBSC and OSMBSC Transport for NSW Bus Livery
63.72	BC/14-23560 (2019) SMBSC and OSMBSC Transport for NSW Interior Decals and Exterior Logos
63.73	Emergency Break Glass Signage on buses to meet Specifications.
63.74	Electronic Ticketing Equipment (ETS) OPAL Coachbuilder Instruction. TfNSW ETS SOW v 7.1.pdf Dated 27 March 2018.
63.75	BC/14-23558 (2015) SMBSC and OSMBSC CCTV and Duress Alarm System Specifications
63.76	Passenger Information Display Appendix 3

63.77	ISO 9001:2015 Quality Management Systems
63.78	Bus Seat Exemption Notice 2014 (New South Wales Government Gazette No 116) and National Heavy Vehicle Standards
63.79	Australian Fuel Standard(Automotive Diesel) Determination 2001.
63.80	Australian Standard AS 4876.1-2002 Motor vehicle frontal protection systems Part 1: Road user protection
63.81	Bull bar tolerances and conditions - Technical Specification applicable in NSW during the exemption period (Extended until
63.82	EN 45545:2013 Fire Protection on Railway Vehicles
63.83	ISO 5658-2:2006 Reaction to fire tests - spread of flame-Part2: Lateral spread on building and transport products in vertical
63.84	ISO 5659-2:2107 Plastics-smoke generation-Part 2: Determination of optical density by single-chamber test.
63.85	ISO 5660-1:2015 Reaction to fire tests-heat release, smoke production and mass loss rate-Part 1: Heat release rate(cone
63.86	ISO 9239-1:2010 Reaction to fire tests for floorings-Part 1: Determination of the burning behaviour using a radiant heat
63.87	ISO 11925-2:2010 Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single
63.88	ISO 9705-2: 2001 Reaction to fire tests-Full scale room tests for surface products-Part 2: Technical background and
63.89	ISO 60332-1-2:2004 Test on electric and optical fibre cables under fire conditions-Part 1-2: Test for vetical flame
63.90	ISO 60332-3-24:2018 Tests on electric and optical fibre cables under fire conditions - Part 3-24: Test for vertical flame
63.91	Transport Asset Standards Authority TS 00013.2:1.0 – Bus Materials: Fire Performance Requirements - DRAFT
63.92	BS EN 50305:2002 Railway applications. Railway rolling stock cables having special fire performance. Test methods.
63.93	BS EN 50305:2002 Railway applications. Railway rolling stock cables having special fire performance. Test methods.