

Attachment 4 Noise Declaration Form

**Single Deck – Diesel (Only) Bus**

<b>Description</b>	<b>Mic Position</b>	<b>Fan Status</b>	<b>Limit dB(A)</b>	<b>Actual dB(A)</b>
Regulation 51.02 (Part A) – TfL Improved Legal Pass-by test highest level	External	Off	80Legal - 1 dB(A)	
Door closing buzzer Interior noise level	Internal	Off	75 dB(A)	
Disabled ramp buzzer exterior noise level	Exterior	Off	75 dB(A)	
WOT from standstill to 16km/h	External	Off	78	
WOT from standstill to 16km/h	Internal Front	On	73	
	Internal Rear	On	74	
Internal noise constant speed @ 16 km/h	Front	On	60 dB(A)	
	Rear	On		
Internal noise WOT from 16 km/h to 40 km/h	Front	On	68	
	Rear	On		
Internal noise constant speed @ 40 km/h	Front	On	67 dB(A)	
	Rear	On		

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**Single Deck – Hybrid Bus**

<b>Description</b>	<b>Mic Position</b>	<b>Fan Status</b>	<b>Limit dB(A)</b>	<b>Actual dB(A)</b>
Regulation 51.02 (Part A) – TfL Improved Legal Pass-by test highest level	External	Off	Legal -79 dB(A)	
Door closing buzzer Interior noise level	Internal	Off	75 dB(A)	
Disabled ramp buzzer exterior noise level	Exterior	Off	75 dB(A)	
WOT from standstill to 16km/h	External	Off	77	
WOT from standstill to 16km/h	Internal Front	On	72	
	Internal Rear	On	73	
Internal noise constant speed @ 16 km/h	Front	On	59 dB(A)	
	Rear	On		
Internal noise WOT from 16 km/h to 40 km/h	Front	On	67	
	Rear	On		
Internal noise constant speed @ 40 km/h	Front	On	66 dB(A)	
	Rear	On		

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**Double Deck – Diesel (Only) Bus**

Description	Mic Position	Fan Status	Limit dB(A)	Actual dB(A)
Regulation 51.02 (Part A) – TfL Improved Legal Pass-by test highest level	External	Off	Legal -1 80dB(A)	
Door closing buzzer Interior noise level	Internal Lower Saloon	Off	75 dB(A)	
Disabled ramp buzzer exterior noise level	Exterior	Off	75 dB(A)	
WOT from standstill to 16km/h	External	Off	78	
WOT from standstill to 16km/h	Internal Lower Saloon Front	On	62	
	Internal Lower Saloon Rear	On	64	
WOT from standstill to 16km/h	Internal Upper Saloon Front	On	55	
	Internal Upper Saloon Rear	On	56	
Internal noise constant speed @ 16 km/h	Internal Lower Saloon Front	On	62	
	Internal Lower Saloon Rear	On	65	
Internal noise constant speed @ 16 km/h	Internal Upper Saloon Front	On	52	
	Internal Upper Saloon Rear	On	54	
Internal noise WOT from 16 km/h to 40 km/h	Internal Lower Saloon	On	70	

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	Front			
	Internal Lower Saloon Rear	On	72	
Internal noise WOT from 16 km/h to 40 km/h	Internal Upper Saloon Front	On	60	
	Internal Upper Saloon Rear	On	61	
Internal noise constant speed @ 40 km/h	Internal Lower Saloon Front	On	69	
	Internal Lower Saloon Rear	On	70	
Internal noise constant speed @ 40 km/h	Internal Upper Saloon Front	On	62	
	Internal Upper Saloon Rear	On	62	

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**Double Deck – Hybrid Bus**

<b>Description</b>	<b>Mic Position</b>	<b>Fan Status</b>	<b>Limit dB(A)</b>	<b>Actual dB(A)</b>
Regulation 51.02 (Part A) – TfL Improved Legal Pass-by test highest level	External	Off	Legal -1 79dB(A)	
Door closing buzzer Interior noise level	Internal Lower Saloon	Off	75 dB(A)	
Disabled ramp buzzer exterior noise level	Exterior	Off	75 dB(A)	
WOT from standstill to 16km/h	External	Off	77	
WOT from standstill to 16km/h	Internal Lower Saloon Front	On	61	
	Internal Lower Saloon Rear	On	63	
WOT from standstill to 16km/h	Internal Upper Saloon Front	On	54	
	Internal Upper Saloon Rear	On	55	
Internal noise constant speed @ 16 km/h	Internal Lower Saloon Front	On	61	
	Internal Lower Saloon Rear	On	64	
Internal noise constant speed @ 16 km/h	Internal Upper Saloon Front	On	51	
	Internal Upper Saloon Rear	On	53	
	Rear	On		
Internal noise WOT from 16 km/h to 40 km/h	Internal Lower	On	75	

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	Saloon Front			
	Internal Lower Saloon Rear	On	71	
Internal noise WOT from 16 km/h to 40 km/h	Internal Upper Saloon Front	On	59	
	Internal Upper Saloon Rear	On	60	
Internal noise constant speed @ 40 km/h	Internal Lower Saloon Front	On	68	
	Internal Lower Saloon Rear	On	69	
Internal noise constant speed @ 40 km/h	Internal Upper Saloon Front	On	61	
	Internal Upper Saloon Rear	On	61	

## ATTACHMENT 15

### Exterior and Interior Notices

A Bus notices booklet “Manufacturers Application Procedure” showing locations and position of all the notices is available from LBSL. The booklet also identifies your contacts for securing supply of the notices and fitment to all new buses.

The following Notices, Labels, Signs or Logos are provided by LBSL on a FOC basis for fixing on all vehicles.

- Interior
  - Labels as in booklet
  - Wheelchair and baby buggy combined notice
  - Priority seats
  - Oyster notice
  - For you safety, Passengers must not stand forward of this point
  - No Smoking
  - For your Safety, Please do not stand on stairs
  
- Exterior
  - London Buses Logo for wheelchair accessible buses
  - Accessibility notices for reduced mobility and wheelchair users
  - London Buses roundel
  - Cleaner Air for London rear signage for hybrid, hydrogen or SCRT and DPF retrofitted buses as per the latest booklet

#### Exclusion

- Any polycarbonate printed labels with high bond adhesive are strictly prohibited

The Bus notices booklet will be updated at any time and should be accepted as the LBSL variation to this specification document.

Additional Operator or Original Equipment Manufacturer Notices are not required.

# ATTACHMENT 1

## **Diesel Bus Emissions Test Process**

The bus for testing provided either by the manufacturer or TfL from an operator shall be to the London specification and fitted with all equipment necessary for operation in London.

An emission testing authority is designated by TfL to ensure comparative standards and quality of testing is achieved.

Manufacturers and / or bus operator are permitted to be present during testing but are not permitted to interfere with or adjust the bus setting without full agreement of the testing authority and TfL. All adjustments will be noted by the testing authority.

The Buses must arrive at the test site with a full tank of fuel, including. AdBlue. A one litre fuel sample will be taken and retained for analysis if required.

The test bus is weighed to obtain the kerb weight and compared to the ULW as certified on the side of the bus.

The emissions test is a laden test with half the bus total seated capacity added to the measured kerb weight to determine the test inertia. A passenger weight of 68kg per passenger is used. A crew weight of 75kg is also added

Tyre pressures are set to the bus manufacturer's recommendation and exhaust system is checked for leaks.

The bus is then linked to a chassis dynamometer in a test chamber for emissions testing. The test chamber is held at a temperature of 18c and speed sensing fans are positioned to simulate actual road speed in the test chamber.

The tests consist of stop-start Millbrook London Transport Bus (MLTB) cycle emission tests as shown below.

The bus engine is warmed up by driving a full test cycle before the actual test. Only equipment necessary to operate a safe testing of the bus is required to be in operation during the emissions test. ie. Heating or cooling etc is not required to be in operation.

The bus will be run over three validated cycles of the above test to produce an average result in the report.

A further test of a static 2 minutes on engine idle and a stationary to max engine power on full acceleration at the same test inertia will also be reported for the same range of emissions.

Bag analysis of HC, CO, NOx, CO<sub>2</sub> and Pm is reported for each test. The cycle is split into two phases (Outer and inner London) and emissions are reported on each phase and an overall test total, in grammes and grammes/kilometre for each pollutant.

The test is completed in triplicate and the following emissions data is reported:



- Engine NO<sub>x</sub>, NO, NO<sub>2</sub>, HC, CO, CO<sub>2</sub> at 1 Hz
- Tailpipe NO<sub>x</sub>, NO, NO<sub>2</sub>, HC, CO, CO<sub>2</sub> at 1 Hz
- FTIR at tailpipe
- Particle number to PMP method
- Two dilute 'bags' collected and analysed for NO<sub>x</sub>, CO, HC & CO<sub>2</sub>
- PM is measured gravimetrically using a single filter paper
- Fuel Consumption in Litres / 100km

The emission test summary sheet showing all 'bag' data is then provided to TfL showing all 'legislated' and TfL requested pollutants.

A full detailed report for TfL evaluation, on the test results and a comparison against an appropriate vehicle, selected by TfL is made by the testing authority.

For vehicles entering service from January 2014 (Euro V1) the emission standards expected are:

NO<sub>x</sub> 1.0gr/km

PM 0.1gr/km

CO<sub>2</sub> 1250gr/km (this equates to a 5% reduction on Euro 5)

## ATTACHMENT 2

### **Hybrid Bus Emissions Test Process and Objective Standards**

The bus for testing provided either by the manufacturer or TfL from an operator shall be to the London specification and fitted with all equipment necessary for operation in London.

The hybrid bus testing process shall follow the same details as set out for diesel buses in Attachment 1 with the following addition.

1. Clamps to measure electrical current or an approved method with the bus manufacturer are fitted to monitor and measure the energy into and out of the battery/energy storage device, during the test runs for the purpose of an energy balancing calculation. The tests are repeated sufficient times to allow a suitable energy balance for compliance with SAE J2711 test methodology to be determined.

The emission test summary sheet showing all 'bag' data is then provided to TfL showing all 'legislated' and TfL requested pollutants.

A full detailed report for TfL evaluation, on the test results and a comparison against the TfL objective Hybrid Bus emissions standard and the DfT/LCVP Green Bus standard is made by the testing authority.

TfL Objective Hybrid Bus Emissions Standards are shown below in g/km as a no more than result

Single Deck up to 12m Overall length

- NOx @ 1.00
- Pm @ 0.020
- CO2 @ 650

Double Deck up to 11m Overall Length

- NOx @ 1.00
- Pm @ 0.020
- CO2 @ 750

## **ATTACHMENT 3**

### **Noise Test Process and Standards**

The completed vehicle supplied for testing either by the manufacturer or TfL from an operator shall be to the latest and complete London specification and fitted with all equipment necessary for operation in London.

A noise testing authority is designated by TfL to ensure comparative standards and quality of testing is achieved

Manufacturers and / or bus operator are permitted to be present during testing but are not permitted to interfere with or adjust the bus setting without full agreement of the testing authority and TfL. All adjustments will be noted by the testing authority.

Exterior drive-by noise testing of the vehicle shall only be conducted on a noise site with a surface that conforms to the requirements of ISO 10844:2010 or better.

The completed vehicle is required to attain passby noise levels 1 db (a) below the comparable legal limit (For diesel only buses) or 2 db (a) below the legal limit (For hybrid buses).

In addition to the legislated Type Approved drive-by noise test to the requirements of part a of ECE regulation 51.02 (or as latest amended) the following LBSL specific noise testing is also required on all buses proposed for operation by each bus manufacturer

The LBSL specific testing should take place at the same time, using the same approval standard equipment and location as the legal drive-by test with detailed results of both provided on the manufacturer declaration.

Specific LBSL testing must reflect a typical in service, unladen vehicle.

The vehicle should be tested with the combustion engine at normal operating temperature, with all engine cooling fans / auxiliary equipment and internal combustion engine functioning at their maximum specified speeds.

The vehicle should be tested with at least 65% tyre tread depth available.

For hybrid vehicles, the manufacturer must provide the designated testing authority with details of how too (or a mechanism too) artificially operate the internal combustion engine at its maximum specified rpm.

For all vehicles, the manufacturer must provide the designated testing authority with information on how too (or a mechanism too) artificially operate the engine cooling fans / auxiliary equipment at its maximum specified rpm

The current LBSL noise levels are:-

- Exterior of vehicle, passby noise test to the requirements of ECE regulation 51 (as amended, test results = diesel only vehicles, legal limit 80 db (a). Hybrid vehicles, legal limit 79 db (a).
- Door buzzer, interior noise measured at 1m from the floor at centreline of vehicle and exit door. limit = 75 db (a)
- Ramp buzzer, exterior noise measured at 1.5m from the vehicle, adjacent to the centre door and at 1.2m from the floor. limit = 75 db(a)
- WOT (Wide open Throttle) acceleration from standstill to 16km/h. exterior of vehicle, 1.5m from the side of the vehicle adjacent to the front doors. 1.2m from the floor. Noise limit = 78 db (a).
- WOT acceleration from standstill to 16km/h. interior of vehicle, 1m height, on centreline of bus on front axle and rear axle datum. Noise limit = no more than 63 db (a).
- Interior saloon, driving at constant 16 kph for 30 seconds on straight road measured at 1m height, on centreline of bus on front axle and rear axle datum, noise limit = no more than 65 db (a).
- WOT acceleration from 16km/h to 40km/h. interior of vehicle, 1m height, on centreline of bus on front axle and rear axle datum. Noise limit = no more than 72 db (a).
- Interior saloon, driving at constant 40 kph for 30 seconds on straight road measured at 1 m height, on centreline of bus on front axle and rear axle datum, noise limit = no more than 70 db (a).

## **ATTACHMENT 6**

### **Materials Fire Retardancy Standards**

The following schedule of component materials Fire Retardant Standards must be verified by each manufacturer and may be subject to independent assessment during or after submission.

All internal components in the bus not specified below must meet the applicable specification in EC Regulations 118.

The current minimum LBSL Materials Fire Retardancy Standards for each type of material used on a vehicle are: -

- All materials forming fire barrier between engine bay and passenger saloons, BS476 Class 1, on engine-facing surfaces. This overrides other points below.
- All GRP materials utilized interior and exterior, BS476 Class 3 front surface, BS476 Class 2 back surface.
- Melamine Laminates (side or roof panels), BS476 Class 2
- All completed flooring (plywood or alternative, including floor covering) BS476 Class 2 on upper surface, BS476 Class 3 on lower surface.
- Seat frames (ABS or Polycarbonate), UL94V0
- Seat assemblies, BS5452 Crib 7
- Body Insulation, BS 476 Class 2
- All internal ABS products (capping and finishing trims), UL94V0
- Body and Floor insulation, BS476 Class 2

The above materials or treatment used to achieve the standard must be capable of achieving the required standard when suitably cleaned or maintained over the operational life of the bus.

Replacement components and their associated material must achieve the original standard.

## ATTACHMENT 7

### Schedule of Bus Type Layouts and General Arrangement Drawings

The following buses showing both the OEM Drg. No. and LBSL Ref No have been approved by LBSL as the layout and general arrangement for each bus manufacturer.

<u>Type</u>	<u>Chassis</u>	<u>Body</u>	<u>Overall Length</u>	<u>OEM Drg. No.</u>	<u>LBSL Ref No.</u>
SD	Enviro 200	ADL	8.6m		E2A/001
SD	Enviro 200	ADL	9.5m	WA4434	E2A/002
SD	Enviro 200	ADL	10.2m	WA4357	E2A/003
SD	Enviro 200	ADL	10.8m	WA4435	E2A/004
SD	Enviro 200Hyb	ADL			E2A/010
SD	Optare	Solo (Slim)	7.8m	29800026	OS/020
SD	Optare	Solo	8.8m	29800028	OS/021
SD	Optare	Solo	9.1m	29800027	OS/022
SD	Optare Hyb	Solo		TBR	OS/023
SD	Optare	Versa	10.4m	32800079	OV/024
SD	Optare	Versa	11.1m	32800080	OV/025
SD	Optare Hyb	Versa		TBR	OV/026
SD	Optare	Tempo	12.0m	28800115	OT/027
SD	Optare Hyb	Tempo		TBR	OT/028
SD	Wright Bus	Streetlight	9.5m	CUS-02360-3	WS/030
SD	Wright Bus	Streetlight	10.2m	CUS-02283-2	WS/031
SD	Wright Bus	Streetlight	10.2m	CUS-02308-3	WS/032
SD	Wright Bus	Streetlight	10.8m	CUS-02246-4	WS/033
SD	Wright Bus Hyb	Streetlight		TBR	WS/035
SD	VDL SB180	MCV	10.3m	464680010000	DM/040
SD	VDL SB200	Wrightbus	11.9m	TBR	DW/045
SD	MAN	MCV		TBR	MNM/050
SD	Mercedes	Citaro	12.0m	3230035696	MC/060
SD	Mercedes C124RLE	MCV	12.0m	TBR	MM/065
SD	Scania	Omni	12.0m	TBR	SS/070
SD	Volvo B7LE	Wrightbus	12.0m	TBR	V7W/080
SD	Volvo B7LE	MCV	12.0m	TBR	V7W/081
DD	Enviro 400	ADL	10.2m	WA4244	E4A/100
DD	Enviro 400	ADL	10.9m	WA4433	E4A/101
DD	Enviro 400 Hyb	ADL	10.2m	WA4247	E4A/105
DD	Wright Bus	Gemini	10.4m	CUS-02383-1	WG/110
DD	Wright Bus Hyb	Gemini		TBR	WG/115
DD	Volvo B9TL	Wright Bus	10.5m	CUS-02385-1	V9W/120
DD	Volvo B9TL	MCV	10.3m	488000000000	V9M/121
DD	Volvo B5 Hyb	Wright Bus	10.4m	CUS-02384-1	V5W/125
DD	Scania	Omni	10.6m	2004732	SS/130
DD	Optare	Optare		TBR	OD/140
DD	Optare Hyb	Optare		TBR	OD/145

**This Schedule will be updated as OEM Drg. Nos are allocated to LBSL Ref. No.**  
OEM's have been instructed not to amend the layouts without consultation with TFL. Any un-referred amendments will be the operator's responsibility to return the buses general arrangement to its original requirements.

**Note. TBR (To be reviewed). Thus, not approved at this issue level.**

## **Attachment 8**

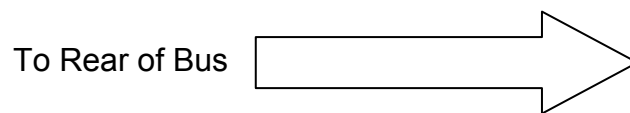
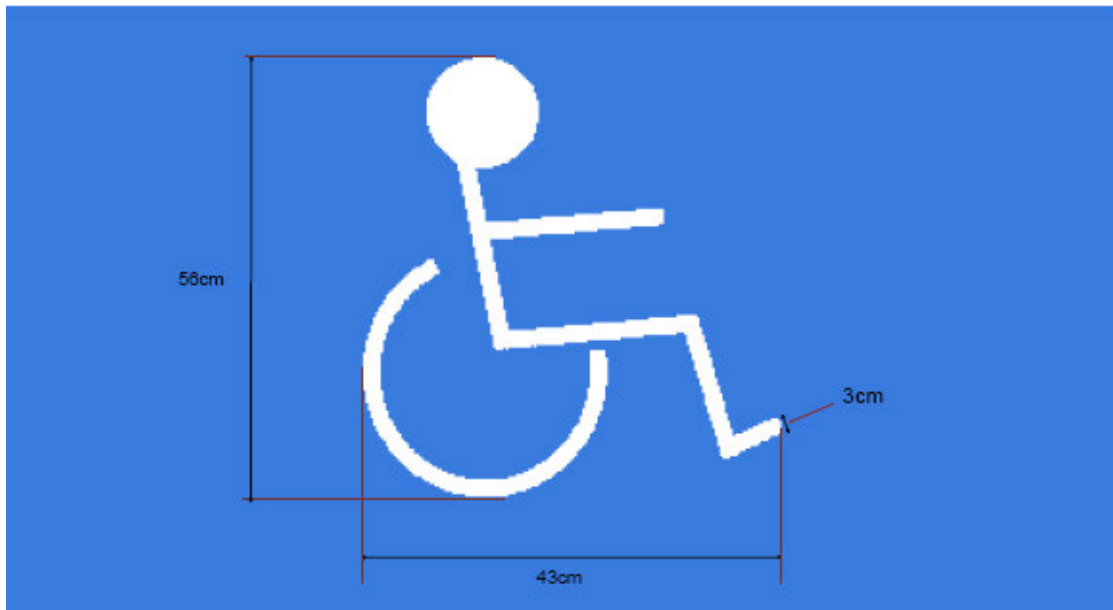
### **Engine Bay Fire Suppression Systems**

In addition to the requirements contained in the operational specification for Engine Bay fire suppression the following requirement is mandatory for all new model types entering the fleet. A full Engine Bay fire risk assessment must be completed for each vehicle type. We would advise all OEM's to carry out the process in conjunction with Fire suppression system (FSS) manufacturers and operators who have the necessary expertise. The outputs from the risk assessment should mandate the type and location of any detection device and provide a detailed location for the dispensing tube or nozzles. It should also detail the FSS maintenance requirements. We expect as standard that all potential sources of fire in the engine bay be protected by an effective FSS this includes any at risk areas behind the engine such as starter motors or filter assemblies. This may increase the length of the trace tube or require additional nozzles. It might also have the affect of having to increase the capacity of the fire suppression cylinder.

It is generally accepted that ABC powder delivered at high pressure is most suitable for Engine bay environments however Water mist systems will be acceptable.

## ATTACHMENT 10

### Wheelchair Floor Logo and Layout



Floor covering of the total Wheel chair bay as shown by manufacturers drawings (Attachment 7) in Blue Ref PMS 300 (As blue in wheelchair notice) and wheelchair logo in plain White. Mild fleck in the base colours may be added to increase durability of the floor covering.

The logo in the wheelchair floor area should be of the identical style to the above and be approximately to the stated dimensions.

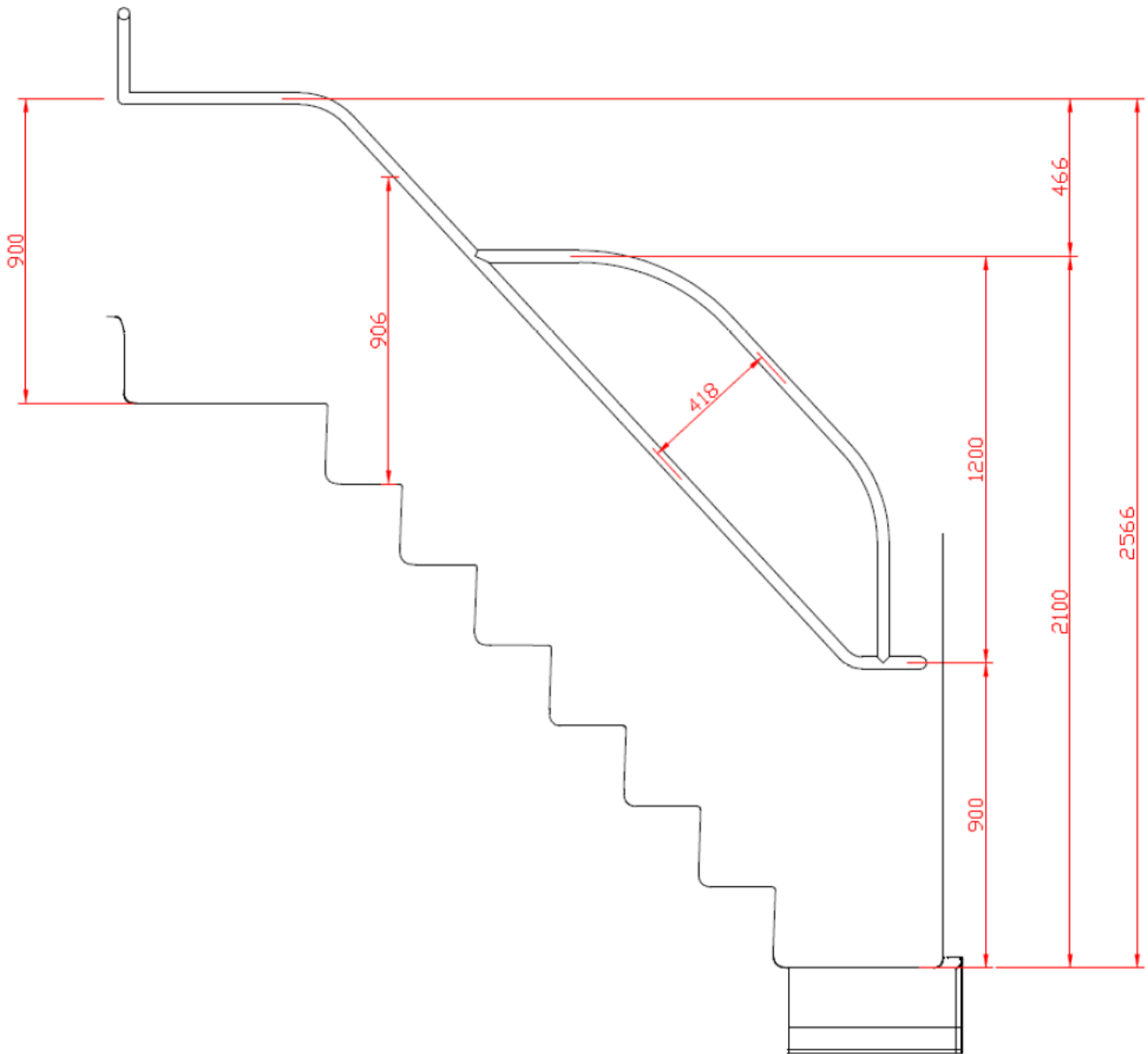
The logo in the wheelchair bay should always be positioned to demonstrate the actual position of the wheelchair.

The horizontal centre line of the logo should be on the centre line of the vertical wheelchair back board and be no more than 550mm from the front of the wheelchair board to the centreline of the logo.



## ATTACHMENT 11

### Body side Staircase Horizontal Handrail Layout



General approximate dimensions and position of body side staircase handrails

A straight hand pole at first joint from top of staircase will also be acceptable

All handrails must be securely fixed to body structure

Open joints or butt / sharp ends to rails are not acceptable. Continuous rails are the preferred arrangement

**Heating and Ventilation System Operational Settings and Testing Process**

All buses must be fitted with a minimum of a fully automatically temperature controlled heating system. No driver cab or engine bay operation should be necessary to adjust or set the passenger saloon heating system during variations of temperature over the summer and winter periods.

Independent driver controlled demisting system and Independent driver controlled cab air conditioning.

All double deck buses must additionally be fitted with an automatically temperature controlled upper deck air cooling system.

Manufacturers should set individual sections of the heating and ventilation system to operate at the following targets

**1. a) Heating**

Capable of raising the temperature from zero to 15°C in 45 minutes rising to and maintaining 17°C within 90 minutes. Test should include the both doors opening for 10 seconds at a time to simulate 15 bus stops in the first 25 minutes and 13 in the next 20 minutes. Maximum air vent velocity of 5 m/s.

**b) Ventilation, see page 13.**

Natural fresh air via opening side windows at all times by passenger selection,

**2. Cab / Drivers Screen Demisting**

Manual Driver selection, Capable of independent operation at all times and raising the temperature from zero to 20° within 25 minutes. Test should include the both doors opening, for, 10 seconds at a time to simulate 15 bus stops in the first 25 minutes and 13 in the next 20 minutes. Maximum air vent velocity of 5 m/s.

**3. Drivers Cab Air conditioning**

Manual Driver selection, Capable of independent operation at all times. However if the drivers cab air conditioning is on, the upper deck air-cooling may function on a slow setting to balance the cooling system, must be capable of reducing the temperature from 35°C to 25°C within 25 minutes. Test should include the both doors opening for 10 seconds at a time to simulate 15 bus stops in the first 25 minutes

**4. Air Cooling (Upper Deck Only)**

Off <23°C, fully shut down, On >23°C, gradual build up to maximum capacity output at 28°C. A maximum cooling capacity capable of a reduction of 5°C is required when interior saloon temperature is 30°C over a 30 minute pull down test as described below. If Driver's cab air conditioning is off, upper deck air-cooling will function independently on its automatic temperature settings

All bus models will be tested in a temperature controlled chamber at a temperature of 30°C and must achieve the pull down procedure shown below to validate settings and efficiencies.

**These requirements will be constantly reviewed and update as technology and manufacturing capability develops.**

## Upper deck Air Cooling Validation Test

The objective of this test is to validate the cooling performance of the upper saloon air cooling systems. This test is carried out simultaneously with a test to validate the cooling performance in the driver's cab.

The bus for testing provided either by the manufacturer or TfL from an operator shall be to the London specification and fitted with all equipment necessary for operation in London.

The testing authority is designated by TfL to ensure comparative standards and quality of testing is achieved.

Manufacturers and / or bus operator are permitted to be present during testing but are not permitted to interfere with or adjust the bus setting without full agreement of the testing authority and TfL. All adjustments will be noted by the testing authority.

The testing authority shall temporarily fit four thermocouples. Three on the upper deck and one in the driver's cab.

The upper deck thermocouples will be located 1.2 metres above the floor of the upper saloon, along the longitudinal centreline of the bus (mid-gangway). The forward / rearward position of the three thermocouples should be as follows;

- Thermocouple 1 (front) should be located at a position aligning with the middle of the seat base of a seat at the very front of the upper saloon on the nearside.
- Thermocouple 2 (middle) should be located at a position aligning with the middle of the seat base of a seat on the 7<sup>th</sup> row (from front) of the upper saloon on the nearside.
- Thermocouple 3 (rear) should be located at a position aligning with the middle of the seat base of a seat at the very back of the upper saloon on the nearside.

The driver's cab thermocouple will be located 1.2 metres above the floor for the driver's feet, on the centreline of the driver's seat base when the driver's seat is set to a mid-position on its forward / rearward slider.

The thermocouples are connected to a data logger capable of recording the temperature at each point at a maximum of 1 minute intervals. The results from the data logger shall be the only results utilised to evaluate the test procedure.

The Bus will be put in a closed climate control chamber set at a temperature controlled to hold 30°C (+/- 1°C). It is permissible to open the vehicle windows, doors or roof vents as considered necessary to speed up the soak time.

The soak condition is considered to be met when all four thermocouples record a steady state of 30°C for a 15 minute duration (+/- 1°C) after a minimum soak time of 1 hour.

It is not permissible to use any additional heat sources within the vehicle during the soak period.

A minimum of 15 minutes of data should be recorded to demonstrate a stable soaked temperature. During this time if the temperature of any sensor drops below 30°C the 15 minutes should be reset.

The bus engine will be started when the following preparations checks are made for the test:

- All windows, roof vents and doors are closed
- The thermocouples are correctly positioned
- The data recorder is running.

When the bus engine is started the upper saloon air cooling should come on automatically (as above 23°C). The driver's cab air conditioning should be turned on, set to maximum capacity, maximum fan speed and if there is a control to direct the airflow it should be directed to the driver position rather than the windscreen. If possible all dash vents, floor vents or ceiling vents in the driver's cab can be directed towards the sensor position as far as practical. If the cab air conditioning has a damper flap to select between fresh air and recirculated air then the recirculated air function should be selected. The drivers windscreen demist system should be turned off and any associated vents closed.

For the complete duration of the test the engine of the bus should be run at the bus engine idle speed. If any recirculation air supply is optional or variable the system should be set to maximum fresh air supply. Any demisting or other system that provides air to the upper saloon must be isolated to not interfere with the test results.

The data logger timer should then start.

The test will measure the temperature drop delivered by the system over a 30 minute period on a minute by minute basis.

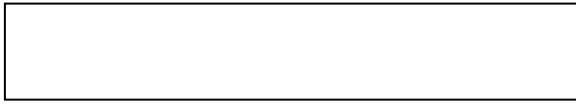
All three saloon thermocouples should achieve the target reduction temperature of 25°C within the first 20 minute period and be capable of holding the temperature below the 25°C for the remaining 10minutes. Averaging the results is not acceptable.

The testing authority will produce a graph of the Pull Down showing the temperature recorded by each individual thermocouple – temperature against time. Ambient chamber temperature will also be included on each graph. A spreadsheet showing the results from each thermocouple and ambient chamber temperature will accompany the graphs.

**ATTACHMENT 13**

**Destination Display Layout**

**Off Side Front  
Ultimate Destination**



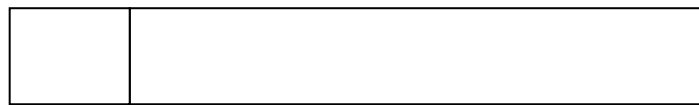
**1160mm x 330mm  
Sight Size**

**Near Side Front  
Route Number**



**450mm x 330mm  
Sight Size**

**Near Side Route Number and Destination**



**Route Number Forward  
270mm x 210mm  
Sight Size**

**Side Destination Rearward  
687mm x 210mm  
Sight Size**

**Rear  
Route Number**



**450mm x 330mm  
Sight Size**

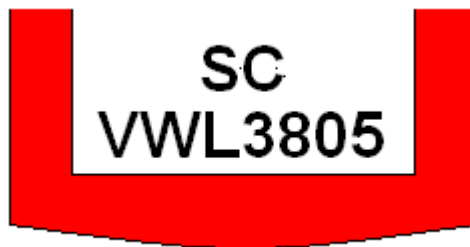
## ATTACHMENT 16

### Operator Codes and Fleet Number Roof Identification

The following operator codes must be used on the roof identification on the first line followed by the operator's fleet number on the second line. The codes must be fitted at the rear of the roof panel in the white panel area as shown in the diagram below

<b>Operator</b>	<b>Code</b>
• Abellio	ABL
• Arriva	ARL
• Arriva Shires	ASH
• Arriva Thames-Kent	ART
• First	FRG
• Go Ahead Group	GAG
• CT Plus	CTP
• Metrobus	MTB
• Metroline	MTG
• Quality Line	QUL
• Stagecoach	STC
• London United	LUB
• London Sovereign	SOV
• Sullivan Buses	SVB

#### Typical Operator Code and Fleet Number Arrangement



Rear of Vehicle

All Characters in New Johnson Bold font  
Characters in Matt Black cut out vinyl  
Characters 350mm in height

## ATTACHMENT 14

### Close Circuit Television System Requirements and Specification

#### 1. General Specification

##### 1.1 Connectivity

- A. The DVR shall have the following interfaces:-
  - i) A Local Area Network (LAN) interface, presented as Ethernet through an RJ45 connection.
  - ii) An integrated 3G modem.
- B. The integrated 3<sup>rd</sup> Generation Mobile Network (3G) modem, there is a preference that this card fits within the Digital Video Recorder (DVR) thus minimising installation costs.
- C. The LAN and 3G modem interfaces shall be password protected and have multiple levels of access i.e. administration, user, read only.
- D. The solution shall provide an open interface accessible via the LAN or 3G modem to allow full control of the DVR. The specification, protocols used and command strings will be provided to London Bus Service Limited (LBSL) on request.
- E. LBSL reserves the right to use these interfaces.

##### 1.2 Function

- A. The image resolution shall be 2CIF or better, 2 CIF will be set as a default.
- B. Each camera input shall be capable of recording at 25 frames per second at the maximum image size and highest image quality concurrently.
- C. The CCTV system shall have the flexibility to select the frame rate for each individual camera up to the maximum rate.
- D. The DVR shall support a minimum total global frame rate of 100 frames per second.
- E. The DVR shall support 16 camera inputs as a minimum.
- F. The DVR shall have an easily removable hard disc for external monitoring or ability to be downloaded via external connection.
- G. Bus data to be recorded on the disc drive
  - i) Bus road speed taken from the GPS, foot brake application and traffic Indicator "left and right" recorded with date and time identification
  - ii) Recording not to be displayed on driver's cab monitor or passenger monitor
- H. All images shall be watermarked or equivalent.
- I. The DVR shall have the capability to record an audio input from two or more microphones.

- J. The DVRs shall use a high compression video codec to encode and store the image data on the hard disk, this shall be one of the following:-
- a. MPEG4 Part 2
  - b. MPEG Part 10 (ISO/IEC 14496-10 version 1)
  - c. ITU-T H.264.
- Note:** the use of any other codec is prohibited
- K. The DVR shall be able to dual stream i.e. code an image at different rates such that a low rate can be stream for Live CCTV and a higher rate recorded to disk for collection later. This shall be possible with one or more of the codecs listed in 1.2J above.
- L. The DVR shall be Live Closed Circuit Television (CCTV) capable so that should LBSL decide to rollout Live CCTV in the future the DVR will support this, more specifically:-
- 1) The DVR shall have the capability to stream video through either of the interfaces, LAN and 3G modem, to a control and management system developed for the solution.
  - 2) The system shall have a documented interface from the control and management system that is made available to TfL for use in a potential Central CCTV Control and Management system.
  - 3) The system's control and management system shall be able to:-
    - i. Manage the video stream i.e. start/stop, pause, Fast Forward, Rewind during the event etc.
    - ii. Select the camera required.
    - iii. Select multiple cameras in thumb nail form.
    - iv. Manage the parameters that control the quality of the video stream.
    - v. Perform System Administration and Operations and Maintenance functions.
- M. The unit shall have an NMEA compatible Global Navigation System interface.
- N. The system clock shall have a resolution of 1 second and the time will be maintained to an accurate to +/- 10 seconds

### 1.3 Diagnostic Interface

- A. The unit shall have the TfL diagnostic interface implemented and approved for use with iBus.
- B. The LAN interface of the DVR will be made available to LBSL for diagnostics and other uses agreed at a later date.

### 1.4 Cameras

- A. All cameras shall be analogue and antiglare
- B. The cameras used shall be high quality colour 480TVL day/night or low light.
- C. All cameras must be housed in a Vandal Resistant Dome or Concealed
- D. Wide angle lenses utilised where necessary to improve vision coverage as identified on Bus type layout drawings in Attachment 7



## 1.5 Displays

- A. The displays shall be LCD colour monitors.
- B. All the displays shall show the time which is derived from the system radio adjusted clock.
- C. The display shall be available in the following sizes:-
  - i) 5" or equivalent suitable for locating in the drivers cab
  - ii) 15" or equivalent suitable for placing in the passenger area

## 1.6 Type Approval

- A. The CCTV systems shall be designed to operate in a public transport environment. The operator will be required to supply type approval for:-
  - i) e Mark
  - ii) Electromagnetic Compatibility.
  - iii) Shock and Vibration
  - iv) Temperature
  - v) Water ingress

**Note:** the CCTV system comprises the DVR, Cameras, intermediate cables, screens, connectors and any ancillary equipment.
- B. The integrity of the type approval shall be maintained throughout the life of the contract.
- C. The cameras should be rated as IP65 as a minimum.

## 2.0 Implementation

### 2.1 Installation

- A. The CCTV systems shall be built in accordance with the TfL CCTV System Installation Guidelines. The key aspects of this are:-
  - i) LBSL approval of the installation, the operator will present the installation instructions for approval prior to build.
  - ii) Documentation, the operator shall maintain the documentation for each build type and make them available for LBSL inspection.
  - iii) Co-existence with iBus, where possible the DVR shall be placed in the same location as the iBus unit.
- B. The DVRs shall be designed to work with the bus native power supply; any additional equipment necessary for this shall be considered part of the CCTV system.
- C. The DVRs shall remain on for 30 minutes once the ignition has been turned off.
- D. Installers of the CCTV system should be accredited to FCS 1362 (formally MPT 1362) or equivalent.
- E. LBSL reserve the right to inspect the installation at source to ensure the standards are being applied appropriately.

### 2.2 Configuration

- A. The image quality configuration parameters will be set to a TfL default as a minimum.

B. Each camera will be set to a frame rate as defined by TfL as shown in the table below.

Location	Reference	Frame rate
Entrance/Exit Platform, wheelchair space and Passenger / Driver Interface	A1, A2	4
Rear of interior seated area	A3, C1	4
General passenger space	A4, B1, C2, C4	4
Forward facing to road	A5	4
Driver's Cab	A6	4
Stair Well	C3	4

**Note:** the reference refers to the camera locations specified in section 2.3.

- C. The operator will ensure that the parameters in Sections 2.2 A and B are maintained throughout the life of the contract.
- D. TfL may choose to change this throughout the life time of the contract.
- E. Note: the parameters will only be changed in exceptional circumstances.
- F. The DVR will provide a minimum of 240 hours of storage space for each bus at the quality and frame rates defined above. The dimensioning of this should account for operating environment i.e. level of movement and lighting conditions.
- G. If the operator uses the CCTV system beyond the minimum requirement set out here any additional CCTV resources that are required shall be supplied by the operator such that minimum requirements set out in this specification are met.

## 2.3 Camera Locations

The cameras shall be identified on the DVR system by the camera alpha numeric code as shown below (When two are cameras used to cover one location /1 or /2 should be added). Cameras must be located in accordance with the following guidelines for monitored areas with the area identified on channels as shown and as approved on Bus type layout drawings in Attachment 7.

All operator required additional cameras identified on subsequent channels as O13, O14 and above as necessary.

### A. Mandatory All Buses (SD, DD)

1. Entrance Platform and Passenger / Driver Interface (Channel 1)
2. Exit Platform, Wheelchair Space and Deployed Ramp Area - Viewing Wheelchair Space only on Single Door Buses under 9m (Channel 2)
3. Two cameras at rear of interior seated area looking forwards covering minimum rear five-way and last four rows of seats. Alternatively use of single camera with a wide-angle lens. (Channel 3 and 4 if two utilised)

4. Between the centre door and the front of the bus which may be mounted either at the front looking rearwards or at the centre door looking forwards. (Channel 5)
5. Forward facing to road ahead of bus (Channel 6)  
Optional / Recommended
6. Interior Drivers Cab looking towards Drivers Signalling Window (Channel 7)

**B. Additional Mandatory All Single Deck Buses Over 10.4m length**

1. Centre door and the rear of the bus, looking rearwards (Channel 8)

**C. Additional Mandatory All Double Deck Buses**

1. Two cameras at rear of upper saloon interior seated area looking forwards covering minimum rear five-way and last four rows of seats. Alternatively use of a single camera with a wide-angle lens. (Channel 9 and 10 if two utilised)
2. Lower saloon between the centre door and the rear of the bus which may be mounted either at the rear looking forwards or at the centre door looking rearwards. (Channel 11)
3. Top of stairwell looking downwards (Channel 12)
4. Front of upper saloon interior seated area looking rearwards (Channel 13)

**Note:** Prior to building of the bus the operator shall confirm that the camera layout drawing has an approval reference (as Attachment 7) given by LBSL. In the case where the layout does not meet the LBSL approved reference / guidelines the operator will be required to revise appropriately.

## 2.4 Displays

- A. There shall be a display in the drivers cab, the display:-
  - i) Shall be a 5" or equivalent LCD colour monitor with EMC certificate.
    - Suitably mounted in drivers cab area
    - Monitor to display the system time clock
  - ii) Shall, as default, display the exit platform and ramp deployment area when the centre exit door opens.
- B. There shall be a display in the passenger area, the display:-
  - i) Shall be a 15" or equivalent LCD colour monitor positioned in the lower saloon, with EMC certificate..
  - ii) Shall be suitably and securely mounted behind a vandal resistant protective screen.
    - Monitor to display the system time clock
  - iii) Shall be generally positioned so that the maximum number of passengers entering the bus will have the opportunity to view the screen when in one of the following positions:-
    - Rearward exit door partition facing forwards
    - Staircase to aisle fascia lower saloon facing inwards to centre of bus
    - Staircase rearward partition facing up the staircase and viewable from lower saloon aisle at staircase entrance.

- iv) Monitor will continuously cycle around all the cameras remaining on each camera for 5 seconds and end with an all camera view.
  - v) Shall be installed in a manner consistent with the current iBus policy.
- C. Use of displays on the upper deck is prohibited.

## 2.5 Security

- A. The DVR and any additional equipment necessary for Live CCTV shall be enclosed in a secure, lockable and vandal proof enclosure that is located in accordance with the TfL design guides.

## 3.0 Operation

### 3.1 Performance

TfL will be providing a diagnostic and reporting capability utilising the current iBus system and will work with the DVR suppliers to ensure the DVR interface (Section 1.3) is developed and approved for use by TfL. The following is based on the use of this capability.

- A. The performance of the CCTV system shall be 98% availability. For a system to be available the following is required:-
  - a. The DVR and ancillaries are fully operational
  - b. The DVR configuration is correct
  - c. The system time is correct to +/- 10 seconds
  - d. All but one of the cameras is working i.e. 1 camera failure is allowed without reducing the availability in the first week. For week 2 and onward the system is considered unavailable.

Availability is defined as:-

$$\frac{\text{Total Time period} - \text{Total Hours unavailable during time period}}{\text{Total Time Period}}$$

Time Period is the sum of all the operational hours of buses operating on contracts compliant with this specification during a period.

Total Hours unavailable during a time period is the sum of all the unavailable hours of buses operating on contracts compliant with this specification during a period

Unavailable Hours are calculated from the time the fault status is made available to the operator to the time the system is fixed.

For a system to be considered as unavailable one or more of the criteria in a. to d. above is not met.

The period is 28 days.

### 3.2 Audit

- A. The operator will be audited to ensure compliance against the required performance. The operator will be expected to maintain records of:-
  - i) CCTV system inspections.
  - ii) Faults identified and date/time fixed.
- B. The operator will provide Availability reports on request.
- C. LBSL shall have the right to audit against the requirements in this specification to ensure traceability and accuracy of the data recorded.

### 3.3 Enforcement

Should the operator breach the availability targets then the operator shall put in place a recovery plan.

### 3.4 Provision of Data

The operator framework agreement contains all information related to the provision of data and should be reviewed as an overview of this Attachment.



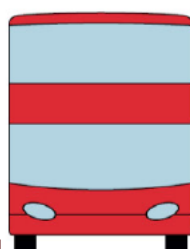
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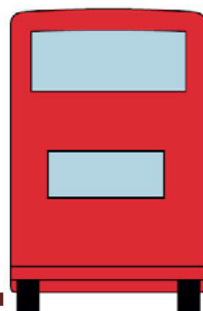
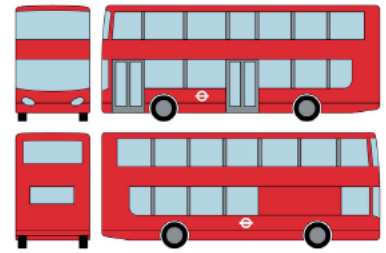
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- 2.18 Electrical systems
- 2.19 Miscellaneous equipment
- 2.20 Notices, Labels, Signs or Logos, Internal and External
- 2.21 Exterior livery
- 2.22 Free issue equipment

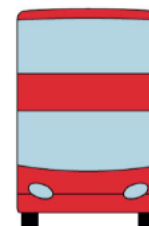




## Attachments

1. Diesel bus emissions test process
2. Hybrid bus emissions test process and standard
3. Noise test process and standards for diesel and hybrid buses
4. Noise declaration
5. Removed
6. Materials fire retardant standards
7. Schedule of bus type layout and general arrangements
8. Engine Bay Fire suppression
9. Removed
10. Wheelchair floor logo layout
11. Staircase handrail layout
12. Heating and ventilation system operational settings and testing process
13. Destination display layout
14. CCTV system requirements
15. Exterior and interior notices. Refer LBSL guidance booklet.
16. Operator codes and fleet number Identification
17. London Buses free issued equipment





## Operational Performance

### 1.1 Documentation

As a minimum requirement, the base vehicle on which the TfL Specification vehicle is based upon as presented to Transport for London must be fully Type Approved to the latest requirements of EC Directive 2007/46/EC (EC Whole Vehicle Type Approval), NSSTA (National small series Type approval) or IVA Individual Vehicle Type Approval. Documentary evidence to support this approval must be supplied at the point of submission of the vehicle. No vehicles without this basic Type Approval will be considered.

It is the desire that the final and complete vehicle specification is also covered by this base vehicle Type Approval, but if the TfL specification vehicle is not covered by the base vehicle ECWVTA then documentary evidence to support any component level approvals must also be supplied"

For all bus types offered, the following must be provided either by the manufacturer or operator, to LBSL:-

- a) The emissions test result for each Euro standard or engine type prior to introduction. Testing procedure are set out in Attachment 1 for diesel buses and Attachment 2 for hybrid buses
- b) A copy of the legal drive-by test certificate. (Inclusive of brake valve and compressor noise test). In addition to the legal drive-by noise test, a LBSL type approved noise statement is required, as set out in Attachment 3.
- c) A declaration from the manufacturer that all components in the bus meet the applicable specification in EC Regulations 118, or as otherwise specified in Attachment 6.
- d) A laden and kerb / un-laden weight chart by axle and total against GVW for the completed bus Body Layout Option will be agreed by LBSL with the relative supplier. Any significant changes to this standard must be notified to LBSL. Un-laden weight has a relationship to fuel economy and buses should be designed to maximise their fuel economy.

### 1.2 Scope

The following considerations must be taken into account within the design

- a) Completed buses must be designed as a low floor bus.
- b) Design should be capable of high frequency stop start, fully passenger laden PSV operational schedules, operating in adverse traffic conditions during typical London weather conditions. Typical performance parameters are 18 hour day, 7 day week, 364 day year operation, with an average operational speed of between 6 to 12mph and a minimum average daily range of 150 miles without the need to refuel the bus.





- c) All buses must conform to all relevant current legislation and take account of any intended legislative discussions that are considered imminent within the first 6 months of the bus's operational life.
- d) The bus proposed must be suitable to achieve a minimum efficient operational life within London of 14 years.
- e) Closed circuit television (CCTV) security cameras, monitors, digital recording devices, iBus and ticketing systems are considered an integral part of the bus design and the necessary visual attention to their installation detail must be taken. Wiring looms should be integrated by the OEM's where possible. It is imperative that the necessary practical detail of assessing these components for maintenance purposes is taken into account.
- f) Design and selection of materials utilised must facilitate ease of cleaning and be maintained to a satisfactory level of appearance throughout the in service bus contract period.

### **1.3 Environmental**

The overall environmental impact of the bus is of significant importance and the following must be incorporated

- a) Engine emissions shall be to the latest legal Euro requirements at time of bus certification. The emissions performance of the vehicles in real world operating conditions can vary to that of the legislative test cycle. Vehicles used on TfL contracts must be able to demonstrate significant improvement in Nox CO2 and PM10 over previous euro standards.
- b) Bus production lead times to certification are to be minimised at times of Euro legislation updates, providing the earliest introduction of latest emissions legislation. No advanced registration of earlier Euro status engines will be accepted.
- c) The combined engine and transmission acceleration controls should limit the bus to a rate that delivers an acceptable LBSL emissions performance and provides the driver with adequate driving acceleration in the fully laden condition, whilst not subjecting the passengers to excessive forces that potentially cause the passengers to become unstable.  
The maximum rate of acceleration should be between 1.0 and 1.2m/s<sup>2</sup> under all load conditions.
- d) Hybrid bus emissions standards over the MLTB cycle are set out in Attachment 2. All proposed hybrid buses must have completed the MLTB cycle for emissions and demonstrate a significant improvement in fuel economy and a reduction of harmful emissions.
- e) The use of BS EN 590:2000 (50 ppm sulphur) compliant diesel fuel is a minimum requirement. Fuel utilised may also be subject to verification by a LBSL testing procedure.
- f) Any alternative fuels, additives, after treatments, power sources or technology that may potentially change the agreed emissions standards will require prior consent of LBSL before their use in London. Manufacturer / Supplier funded



testing over the MLTB cycle under LBSL supervision is required to establish that the technology proposed delivers emissions standards that are better than the equivalent currently used standard bus.

- g) Noise and vibration emitted from the bus to the exterior and interior is of particular concern. The legal drive-by noise testing for diesel and hybrid buses is extended as stated in Attachment 3.
- h) Exhaust fumes must be delivered on or below bus skirt to the rear of the bus, preferably off side rear or on the off side rearward of the rear axle. Near side is not permitted. If any exhaust fumes are not delivered on or below bus skirt level, they should be delivered at roof level with the final position agreed with LBSL prior to bus manufacture / design.
- i) To prevent engines running long periods at idle, an automatic engine shutdown system should be incorporated. The engine should be automatically shut down when the bus is stationary for 2.5 minutes, with the park brake applied. The driver will be provided with an audible 1 minute warning of the shut down and have the facility to override back to the 2.5 minutes of stationary operation.
- j) A statement of the carbon footprint from the respective manufacturer (excluding fuel, oil and tyres used during operation) covering initial manufacturing to disposal over a 14 year life cycle is required for bids with hybrid bus options.

#### **1.4 Safety Features**

In addition to the items covered in the following technical specification, special safety features are required as follows:

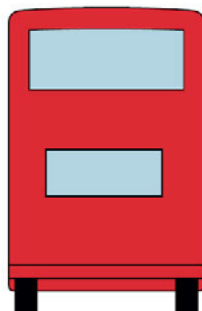
- a) Fire Retardancy Requirement, materials utilised must meet the requirements given in appendix 6.
- b) Engine compartment fully automatic fire suppression system, capable of extinguishing an engine bay fire before serious bus damage is sustained or passenger safety is compromised. The system should provide accurate and early detection, and multi point dispensing, targeted at high-risk sections of the engine bay. Driver manual activation or override is not allowed. Driver audible notification on bus start up that the system is operative with immediate audible notification of fire detection is required. On fire detection, the fuel system to the engine bay must be shut off to ensure no further fuel is supplied to the engine bay area and an effective isolation of the fuel tank supply is achieved. Power to the cooling fan must be removed. Refer to attachment 8 for additional details.
- c) On double-deck buses, in the upper deck rear seated area, a concealed smoke detector is required with a warning device incorporated into the driver's audible information.
- d) The legally required manual engine emergency shut down device must be accessible without the need to open the main engine bay cover. It must also be



of a type that allows the engine to be restarted from the driver's cab, provided the main rear engine bay cover is closed. The main engine bay cover must be kept locked when the bus is in service.

- e) All wheel arches fitted with tyre blow out protection liners
- f) Anti slip floor covering with joints minimised. Colour contrasting step nosing must be used on all step edges in accordance with the PSVAR 2000.
- g) Cross hatching (or any other marking) of the floor area, particularly forward of the "Do not stand forward of this point" sign is not allowed.
- h) Particular attention should be made to ensure headroom at all positions throughout the bus is sufficient without the need to provide impact protection or warning notices.
- i) If interior panel / corner finishing is utilised, it should be of suitable quality / standard to cope with high wear operation, and if damaged, should not present an immediate increased safety risk
- j) Double-deck buses are to be fitted with a substantial near side front tree guard, located into the structure of the bus, giving additional forward protection to the front seated passengers, exterior dome and near side corner window-pillar.
- k) Emergency Exits

In addition to emergency controls on main entrance and exit doors, exits may be provided via main saloon windows or a suitably positioned exit door. These window positions or door must be shown on the general arrangement drawing as approved in Attachment 7.





## 2 Technical Specification and Arrangements

### 2.1 General Dimensions and Capacities

- a) Manufacturers must have general dimensions, seating and layout arrangement drawings agreed by LBSL as scheduled in Attachment 7. These individual manufacturers' drawings may contain minimal deviations to the detail below and have been approved by LBSL if given a LBSL reference number. The respective manufacturer's LBSL reference number must be quoted on all proposals. If a manufacturer cannot provide the approved LBSL reference number, a fully dimensioned general arrangement drawing for the proposed bus must be provided with the bid for LBSL review and approval.

Any amendments to any of these layout drawings will require the prior approval of LBSL.





*General dimensions and capacities are shown below but may be varied by  
Clarification on the approved general arrangement drawing*

		Single Deck Up to 10.5m overall length		Single Deck 10.5 to 12m overall length		Double Deck 10 to 10.9m overall length	
		Min	Max	Min	Max	Min	Max
Overall Width	Metres	2.5	2.55	2.5	2.55	2.5	2.55
Overall Height	metres	2.85	3.1	2.85	3.1	4.2	4.42
Aisle headroom at centre line	metres	1.83		1.83		1.83	
Seat Width	mm	440		440		440	
Aisle Width (between seats)							
top of seat back	mm	590		590		590	
bottom of seat back	mm	535		535		535	
Objective Wheelchair space	metres	1.60		1.60		1.60	
Objective Seat Pitch	mm	750	800	750	800	750	800
Entrance & Exit step Height	mm		320		320		320
Kneeling to	mm	265	240	265	240	265	240
Entrance & Exit Door Headroom	mm	1840		1840		1840	
Entrance Door Clear Width	mm	1035		1035		1035	
Exit Door Clear Width	mm	1200		1200		1200	
Passenger Capacity							
Total		60		70		87	
Low Floor Seated: Priority		4		4		4	
Low Floor Seated: Preferential		2	4	4		2	
Total Seated Lower Deck		26		35		22	
Total Seated Upper Deck						41	
Total Standing		27		Max to GVW		22	
Wheelchair		1		1		1	
Standing with wheelchair		22		Max to GVW		12	



## **2.2 Transmission**

Electronically controlled automatic transmission integrated into engine management system. The transmission must be capable of effective control and adjustment of acceleration, deceleration and road speed in all gears and modes.

## **2.3 Suspension.**

High quality ride characteristics typical of a 4 or 6 air bag system is required.

## **2.4 Steering.**

Power operated with adjustable column for rake and reach.

## **2.5 Brake System.**

ABS and all round disc systems are encouraged to minimise potential brake noise / squeal.

To reduce the risk of fire due to a blockage or severe restriction in the main supply pipe from the compressor, a Pressure Relief Device (PRD) must be fitted in line between the compressor and the first valve in the compressed air system. Care should be taken to position the device/valve so that it receives a good cooling air flow and minimises the risk of secondary fire/heat damage, caused by very hot air being exhausted from the PRD.

## **2.6 Noise Performance**

London Buses require the legal drive-by test levels to be 1 dB below the legal limit (diesel buses) or 2 dB below the legal limit (hybrid buses).

The method and additional testing requirements are set out in Attachment 3.

All noise test results may be subject to LBSL verification at any time.

## **2.7 Doors.**

London Bus generally operate a two door system with the entrance door forward of the front axle and the exit door between front and rear axle. When single or three door buses are requested, the front door remains unchanged, the centre door is deleted or duplicated at a specified area of the bus. Requirement for all doorways are as follows

- a) Entrance and front door exit only to provide an individual clear width of 1035mm minimum (1100mm for single door vehicles excluding door mounted handrails) and utilise an equal width two door leaf closure
- b) Exit doors to provide an individual clear width of 1200mm minimum (excluding door mounted handrails) and utilise an equal width two door leaf closure
- c) Front, entrance to be inward glider type, flush fitting to the body side when closed and one piece full depth glass in each door leaf for maximum driver view of kerb side.



- d) Centre or rear, entrance or exit doors to be outward slider type, flush fitting to the body side when closed and one piece full depth glass in each door leaf for maximum view of kerb side.
- e) All door header panels must provide adequate prevention against finger ingress to the door operation mechanism
- f) Door or door partition handrails positioned to assist boarding and alighting must be fitted at all entrance and exit points and must be shown on the approved arrangement drawings as Attachment 7.
- g) The emergency door controls fitted to entrance and exit doors must be disabled automatically by way of an interlock, when the bus is travelling at speeds above 5kph.
- h) Overhead illumination, of door opening area must be provided at minimum levels as stated in Paragraph 2.18d.
- i) Door closing audible warning device on all exit doors, to be of beeping sound and not to exceed 75dba, when measured at 1m height from the body floor on centre line of the bus and exit door
  - White sound noise type will also be considered
  - Voice or other tones are not acceptable.
  - Warning on exit door opening is not permitted

### **2.8 Seating.**

Operators are encouraged to provide generous seat pitches throughout the bus to permit ease of movement and local stowage of hand luggage. Particular attention to generous spacing should be given to the seats in the upper saloon on double-deck buses. General arrangement drawings and capacities are agreed with LBSL by manufacturer as Attachment 7 and should not be adjusted without prior approval from LBSL

The general arrangements must comply with the following:-

- a) Individual passenger seats of minimum 440mm width at all positions, including moulded panel areas except when identified and accepted on drawings in Attachment 7
- b) Seats with securely fixed, replaceable seat and back pads. These seat and back pads should be of sufficient thickness and quality to provide a good quality of comfort and support for passengers.
- c) Seat backs and pads moulded into body panels must provide equivalent levels of comfort to that provided by the main saloon seating.
- d) Seats should be suitably designed to restrict the potential of pickpockets to operate whilst utilising the seating immediately rearward.
- e) Tip up seats are not permitted, anywhere on the bus
- f) Forward facing seats are the preferred layout, except where the chassis design function over wheel boxes necessitates inward or rearward facing
- g) A minimum of 4 priority seats which at least meet the legal space requirement in the low floor area for disabled passengers and must be clearly identified by the standard (LBSL Issue) notice.



- h) A further 2 preferential passenger seats of similar space requirement to the priority seats, in the low floor area, for passengers who are less able to stand or travel with small children. These must be clearly identified by the standard (LBSL Issue) notice.
- i) Priority or preferential seating on the low floor area shall have:-
  - Under seat space maximised as much as possible to free the under seat space for use by guide/assistance dogs.
  - The height to top of seat cushion should be approx 490mm to maximise under seat space
- j) All of these seats will be fully determined on the approved seating layout as scheduled in Attachment 7.

### **2.9 Wheelchair position and access.**

All buses must make provision to carry a wheelchair and its occupant with their entrance and exit via the door positioned mid wheelbase on two or more door buses and front door on single door buses.

- a) Ramp requirements:
  - Power operated by driver controls
  - Telescopic single plane ramp platform type with minimal deviations in surface plane
  - Exterior ramp request buttons adjacent to the wheelchair entrance / exit door must be positioned clear of the open door position.
  - Protection of the ramp from damage is a priority and specific attention should be given to its installation to improve operational reliability.
  - Ramp deployment audible warning device at door to be of beeping sound and not to exceed 75dB(A), when measured at 1.25m height from the exterior ground on centre line of the exit door at a distance of 1.5m.
  - On every start up of the bus, the ramp mechanism must automatically undertake a partial operation extending cycle of approximately a 50mm deployment to test the ramp and remove any loose dirt or debris from ramp mechanisms. The ramp deployment audible warning device must not sound during this test operation.
  - If operation of the ramp fails in service a permanent warning light must be displayed in the driver's cab until a successful ramp operation occurs.
  - Access ramps must function on all kerb surfaces likely to be encountered on London streets.
  - The ramp forward edge is to be recessed at the centre door from the main bodywork exterior by not less than 25mm but ideally where possible 35mm. The area between the lower edge of the closed door leaf and the floor should be protected against water or any other form of material ingress.





## **b) Wheelchair Bay requirements**

- The wheelchair bay is to be located on the off side, opposite the wheelchair entrance / exit door on two or more door buses. Wheelchair bay length is to be at a minimum of 1.60m. Special attention is required in this area to ensure Anti-slew hand poles and vertical hand poles do not compromise access and egress to the wheelchair bay area. All layouts must be agreed and aligned to manufacturers drawings in Attachment 7.
- The wheelchair bay on single door buses should be located on the off side, immediately rearward of the driver's cab and wheel box where appropriate.
- The wheelchair interior manoeuvring area and the ramp deployment area must be monitored by CCTV and displayed on the driver's cab monitor when doors are open.
- Wheelchair bay to provide alternative buggy space and standing area when not in use for wheelchair location. Suitable hand rails and leaning rails must be provided for this purpose
- A wheelchair logo is to be incorporated into the floor covering, readable as you face the off side (The logo displaying the rearward facing position of the wheelchair). The full wheelchair bay area to be in blue (as close as possible to the blue used on the wheelchair notice, PMS 300) and the wheelchair logo in white. The wheelchair logo must comply in size and image to that shown in Attachment 10. The designated wheelchair bay area must be shown on the respective manufacturer's bus layout drawings in Attachment 7.
- The main floor covering surrounding the wheelchair bay is of operator choice but must be in a contrasting colour from the full wheelchair bay area.
- The wheelchair bay area wheelchair security floor to ceiling handrail must have two bell pushes. The lower (blue button, facing forwards) to activate ramp request (as PSVAR2000) and a higher (red button, facing rearwards) as a standard bell push. Blue bell push to activate an alternative sound and independent driver's cab ramp request light to the standard bell push.

**Note:** A manual or automatic security arm replacing the floor to ceiling handrail is not permitted.



## 2.10 Windows and Glazing

a) All windows and glazing to meet ECE Regulation 43

b) All side glass windows (excluding doors and driver's signal window) of identical tinted glass, where legally permitted.

- Solar energy transmittance of not more than 65%
- Light transmittance of not more than 80%

Passenger opening side windows of Hopper design are to be provided on single deck buses:

- At all full size bays.

On Double Deck Buses, Options for upper saloon only to be agreed with LBSL

- At all full size bays on the lower deck
- At foremost full size bays, nearside and offside, on the upper deck
- At rearmost full size bays, nearside and offside, on the upper deck
- At one other full size bay nearside and offside, on the upper deck
- It is expected that at least 11% of the total surface side glass area (excluding door glass and destination glass) will be of the open hopper type providing an open area air gap of not less than 3.5%

b) Driver's cab signalling window to be fitted with anti bandit glazing

c) Driver's front screen to have top tinted section or a suitable sunblind

## 2.11 Staircase

Double-deck buses must have a forward ascending 9 step straight staircase with a step tread depth not less than 230mm, and a step riser of not more than 245mm located as on the agreed bus layout drawings in Attachment 7.

a) Hand rails must be provided to both sides of staircase, continuous throughout its profile, with no potential hand traps

- An additional off side (body panel side) horizontal handrail on the staircase is required, to improve passengers' handhold options when using the staircase. Attachment 11 shows a typical arrangement as an example.
- Exposed butt ends to handrails are not acceptable anywhere on the staircase or its access

b) Particular attention should be made to ensure headroom at staircase lower steps is achieved without the need to provide impact protection. Finishing edges should be high quality moulded covers that cope with high passenger volume operation



- c) If transparent materials are used to provide the aisle side staircase panel in the lower salon, it should be of obscured material to achieve a decency screen for staircase users.

## 2.12 Driver's Cab.

The general layout should be considered suitable as a working environment and be ergonomically designed to assist and protect the driver.

- a) Cab air conditioning system is to be provided, fully controlled by the driver
- b) Cab screen demisting system is to be fully controlled by the driver and capable of independent operation to the saloon heating, upper deck cooling or cab air conditioning.
- c) Driver's vandal screen is to be provided utilising an appropriate protective material. The screen should be suitably mounted to fully protect the driver from assault with particular attention given to the door security and the area between the door and the front screen. The installation and fixings in these areas must be able to withstand sustained physical attack without becoming insecure and putting the driver at risk. The screen must be rattle proof, free of any serious reflections and not restrict or distort driver view to passenger entrance, wing mirrors or forward exterior view.
- d) Driver must be further protected by an independent "siren / common network fleet sound" assault alarm also activating the bus hazard lights.
- e) Driver operated PA system (for driver to passenger communications) will be provided as part of the iBus system.
- f) The cab area must be designed to accommodate the iBus system as described in section 4.3.2, 4.9 and 4.10 of the generic iBus installation manual (BHN01 1709 70V15) with details of the optimal and acceptable zones recommended for placement in the cab of the driver's iBus MDT terminal, microphone and speakers.
- g) The cab area must be designed to accommodate the ticketing equipment as described in electrical section and in the specification document "Guidelines for Bus Builders for the installation of Ticket Machines with Smart Card Readers", published by the ticketing system supplier and available from LBSL.
- h) Power supplies to be maintained to the card reader for 30 minutes after shutdown.

**Note:** This installation guideline is for standard one-person operated buses and that the requirements for a non standard design of bus or types of operation should be discussed with LBSL at the earliest opportunity, before the bus specifications are confirmed to the supplier.



### **2.13 Heating and Ventilation**

Passenger saloon general ventilation should be provided by opening (hopper vent) side windows as specified in Paragraph 2.10

Additionally all buses should provide:-

- a) Fully automatic heating and ventilation system with saloon operational temperatures set as shown in Attachment 12
- b) Blown air heating and ventilation system to both lower and upper deck where appropriate. The system should provide a good circulation of air throughout the length of the bus interior. Convection only systems are not acceptable.
- c) Fully automatic thermostatic control of the system. The thermostatic sensors should be positioned to reflect the interior, upper and/or lower deck temperature of the bus and be in a tamper proof location. Heated or unheated air should be circulated throughout the bus dependant on interior bus temperature

It should not be necessary for the driver, maintenance teams or any other parties to adjust or set the heating or ventilation system during variations of temperature, such as during summer and winter periods. If engine bay “maintenance only” shut off valves are required, they must utilise an independent hand tool and not be capable of being adjusted by lever or hand operation. The system should be designed to enable a full operational check of component functions and settings in the regular service routine.

Double-deck buses should further provide:-

- d) Upper saloon air cooling system with saloon operational temperatures set as shown in Attachment 12
- e) Upper saloon air cooling system capable of reducing the internal saloon temperature by 5°C when subject to an interior saloon temperature of 28°C by inputting at variable fan speeds suitable quantities of conditioned and cooled air via saloon length ducting. A LBSL pull down test as Attachment 12 must be submitted to establish the performance of the upper deck cooling system
- f) installation and positioning of the cooling system equipment / components / vents which is unobtrusive to passengers, and presents no safety hazards
- g) Integration of these systems into the fully automatic heating and ventilation system to avoid operational conflicts and maintain operation as shown in Attachment 12

The driver should have no method of overriding the automatic heating / cooling systems for the passenger section of the bus and any maintenance or testing function must be automatically reset to its full operational condition after every engine restart.



## 2.14 Handrails.

In accordance with and as shown on the agreed general layout drawings as Attachment 4 incorporating the following:-

- a) All handrails and stanchions to be between 30mm and 35mm diameter smooth tube with powder coating (matt crackle finish) or nylon dipped (matt crackle finish). Coloured, yellow (RAL 1028), green (RAL 6018) or orange (RAL 2028). Any alternative colours will require the prior approval of Contracts Tendering Manager at LBSL.
- b) Staircase handrails should be of identical cross section to the main saloon handrails
- c) A longitudinal waist height handrail is required, to provide a continuous passenger waist height hand grip support from the entrance / cab area to the beginning of the seated area or staircase steps
- d) Door or door partition handrails positioned to assist boarding and alighting must be fitted at all entrance and exit points
- e) Exposed butt ends to handrails are not acceptable anywhere on the bus. End of rails should be in a closed position or curved to provide a safe introduction to the rail
- f) Seat-back to ceiling handrails (with bell push) are required at all forward facing seats on lower saloon and alternate seats on upper saloon
  - All bell push buttons to be in red with contrasting surrounds to the red and the operator selected hand pole colour
  - All bell pushes are required to be marked in brail with the brail symbol for the letter S



and the word STOP in white, on the bell push button. This is to provide additional assistance to the iBus audible information announcements

- g) Where horizontal hand rails are fitted in standing areas, bell pushes, as described above, must be placed in a position so as to limit the risk of accidental activation by passengers leaning on them.
- h) Horizontal rails above wheel chair and / or standing area to be fitted with hanging grab hand holds of the flexible type. These grab hand holds should only be used in the low floor area and must not be placed in entrance / exit doorway areas.

## 2.15 Route and Destination Display

Power operated front, side and rear displays with route selection unit in driver's cab simultaneously controlling front, side and rear displays.

It is the operator's responsibility and essential that all displays are correctly positioned and coordinated whilst a bus is in service, regardless of the equipment type used. A suitable method for the driver to identify from the cab seat that the front display is correctly positioned must be provided. Dimensions for all display units are shown in Attachment 13 for double and single deck buses.



- a) All displays in Transport for London's Classic Johnston font
- b) All displays in White font on black background including out of service or any other passenger information
- c) All displays to be fully back illuminated by LED type lighting systems and automatically illuminated at all times, positioned at the horizontal centreline of each blind, providing an even distribution of illumination across the full blind area.
- d) No light illumination gaps should be visible around any point on the displays from the exterior view of the bus.
- e) No logos, signs or abbreviations are permitted on the display. The approved ultimate and intermediate display wording will be provided against each contract award
- f) Where double letters or numbers occur on any display, additional separation space is to be provided to improve identification
- g) Blind jockey rollers or other devices must be utilised when necessary to keep blinds taut and as close as possible to the glazing line
- h) All displays to have exterior anti vandal impact and anti reflection overlay

Front Route display to have ultimate destination with single track number in a side by side arrangement.

- a) Front visual display to be no smaller than that shown in Attachment I3
- b) Ultimate destination to be maximum height size available with a % deformation in font size height, where necessary, to accommodate long destination points
- c) Ultimate destination sight size of not less than 1160mm width and 330mm height
- d) Route number to utilise full depth available from display height, sight size of not less than 450mm width and 330mm height
- e) Front destination identification to be viewable from the driver's cab
- f) Blind destination to display ultimate destination only, no intermediates, logos, qualifiers, curtailment points or any other information that is not part of the approved contract award wording

The nearside route display must have the ultimate destinations and single track number in a side by side arrangement. The route number must be shown to the forward most point of display.

- a) Equipment may be a combined single track or split number but either must achieve the dimensions shown in Attachment I3
- b) Ultimate destination and route number to utilise full first window bay width
- c) Side visual display to be no smaller than shown in Attachment I3
- d) Ultimate destination sight size of not less than 687mm width and 210mm height
- e) Route number to utilise full depth available from display height, sight size of not less than 270mm width and 210mm height



- f) Character centreline height not less than 1200mm and not more than 2500mm from ground at bus ride height. Rear route display to have number identical to the independent front route number display.

## 2.16 CCTV

Colour Digital CCTV is to be fitted to all buses. The functionality detailed in Attachment 14 is in line with the current developments within the industry which have pushed the capabilities of the DVRs forward considerably. Developments are now being made to provide live streaming of video images which comprise the on bus CCTV systems and remotely located management software. LBSL wishes to keep this option open for future use.

## 2.17 Body Insulation

Full bodywork insulation to sides, roof, front and rear, where appropriate to ensure noise and heating standards are maintained.

The floor and supporting bulkheads between the engine and passenger area are to be well insulated against noise and heat intrusion.

## 2.18 Electrical Systems

The following equipment must be provided on all buses

- a) Day time running lights. (Note: These may be independent of headlight system, provided a sufficient light intensity is provided to enhance bus visibility in daylight)
- b) Reversing alarm “white sound” with driver’s cab time delayed isolation override
- c) Bus stopping illuminated signs on both decks are part of the iBus system and both are suitably positioned for maximum visibility to passengers. Suitable mouldings and fixings for the TfL provided iBus signs must be provided. Duplication to this iBus signage is not permitted.
- d) Interior saloon lighting to provide at minimum:
  - Seats: 150mm above cushion level  
150 lux
  - Aisles: Floor level, on bus centreline adjacent to all seats  
100 lux
  - Steps: Floor level, centre of entrance and exit steps  
100lux
  - Double deck stairs: Floor level, centre of every tread  
100 lux
  -
- e) An automatic system for interior saloon lighting to turn off when exterior ambient illumination levels determine no supplementary illumination is required in daylight
  - Turning on of the interior lighting will remain under driver’s control



- f) Induction loops that provide driver communication to passengers with T band equipment are necessary to the following requirements:-
- Passenger entrance platform / cab interface area to be covered by induction loop
  - Driver's cab microphone for communicating with T band passenger, active at all times when the bus is in service.
  - Additional induction loop for the wheelchair bay area receiving driver communication from cab microphone and linked to passenger iBus information of next stop and all other messages.
  - Nationally accepted sign on cab door and wheelchair bay area identifying T band driver communication available is provided within the notices, labels, signs or logos section
  - It is required that the induction loop system will be linked to all iBus announcements
- g) Provision of electrical supply to the ticket machine
- The ticket machine base position must be provided with a clean continuous power feed at all times. For full details, refer to the installation and provision of electrical supply to the Ticket Machine as described in the document "Guidelines for Bus Builders for the installation of Ticket Machines with Smart Card Readers", published by the ticketing system supplier and available from LBSL.

## 2.19 Miscellaneous Equipment

The following operational equipment is required

- a) Used ticket bins are not considered necessary due to the low level of tickets issued. They should not be fitted to any position on the bus.
- b) Driver's near side and off side wing mirrors in full colour yellow
- No additional warnings or markings are required on the all yellow mirror head
- c) Running number boards (if utilised) must be positioned and displayed in a manner that cannot be misinterpreted as a route number and specifically not in the front windscreen area.
- The character font must be yellow on black
  - Font size shall not greater than 200mm in height
  - Display of a professional appearance.
  - Soft print copy taped or positioned adjacent to windows is not permitted





## 2.20 Notices, Labels, Signs or Logos, Internal and External

Mandatory interior labels, provided by LBSL, will be located in the approved positions of; exterior driver's rear cab bulkhead or staircase fascia on lower saloon and cove panel immediately opposite top of staircase on upper saloon, one per single deck and two per double deck. Labels must at all times display the current bus registration number

- a) Exterior and interior notices are provided by LBSL as listed in the notices guidance booklet, and must be fitted in the appropriate positions.
- b) All as described in booklet Manufacturers' Application Procedure.
  - The above notices may be obtained by bus manufacturer or operator FOC from the current supplier Stewart Signs.
- c) Specific operator notices not permitted, such as
  - Operator specific Welcome Aboard notices (ON DRIVER'S CAB DOOR, PANELS, GLASS OR IN FLOOR COVERING)
  - No notices, information, legal address, recruitment or any other advertising material is permitted on the interior or exterior of any window without prior permission of Contracts Tendering Manager at LBSL.
  - CCTV advisory notices
- d) Notices provided by operator must be fitted in the appropriate positions:-
  - Fleet numbers and operator identification code on roof. Operator codes as shown in Attachment 16. Black cut out lettering of operator code over fleet number, character New Johnson Bold font 350mm in height, positioned on centre line of bus, transversely at rear of white roof section
  - Operator logo positions as agreed in management document illustrations for each operator
  - All external and internal legal notices, in a single contrasting colour, cut out type if appropriate
- e) All notices and signs to be in Transport for London's "New Johnson" bold or medium font unless legally required otherwise
- f) Exterior advertising panels are permitted in the following areas when bus width permits
  - Off Side
  - Near Side
  - Rear

All advert panels must be framed with frame in London Bus Red, except where specific LBSL authority has been given to support a particular activity

Any non standard, illuminated or special in any way advertising method or advertising display must be approved by LBSL prior to installation.



## 2.21 Exterior Livery

All buses shall be painted in a livery that is fully London Buses Red Reference ICI P498FPF3 or exact colour equivalent with the following exemptions

- a) White roof panels on both single and double decks to interior cove joint (i.e. not visible from pavement level) for heat rejection
- b) Road wheels are not to be repainted and should remain in the OEM's standard finish
- c) The TfL Roundel is mandatory and should be fitted in accordance with guidance contained in the latest LBSL booklet.

Should the livery illustration(s) incorporated into your Framework Agreement not include a livery as described above, you should enclose a copy of the rear, front and side illustrations in colour of such a livery. This will be subject to prior approval by LBSL.



## 2.22 Free Issue Equipment

The following equipment will be free issued on request by LBSL to operator or manufacturer against each tender award. Its provision for installation and suitable protection must be provided

- a) iBus installation and equipment as listed in Attachment 17. For full details of the installation principles recommended, refer to the generic 'iBus Installation Manual' [Document Ref: LBSL Equipment for new buses Installation manual BHN01 170970V15] which has been issued to all bus manufacturers. A copy of the 'iBus Installation Manual' is available on the Hyperion server to all bus operators.
- b) Ticketing machine, base plate and smart card readers. For full details, refer to the installation and provision of electrical supply to the Ticket Machine as described in the document "Guidelines for Bus Builders for the installation of Ticket Machines with Smart Card Readers", published by the ticketing system supplier and available from LBSL.

**Note: The ticket machine and equipment will be installed after a bus arrives in London.**

- c) All Notices as listed in THE LATEST LBSL BOOKLET

