

## Simulated Zero Emission Bus Certificate

Customer:	Alexander Dennis	DYNAMOMETER SETTINGS			
Customer Address:	Cameron House, Priorswood PI, Skelmersdale, Lancs	Telematics Capability	Yes	Test Weight	15821 kg
Test Purpose:	Zero Emission Bus Testing	Maximum Speed (km/h)	92 km/h	F°	N/A N
Vehicle Manufacturer:	Alexander Dennis	Seated Capacity	80	F <sup>1</sup>	N/A N/kmh
Vehicle Model Name:	Enviro400EV	Passenger Capacity	94	F <sup>2</sup>	N/A N/kmh <sup>2</sup>
Powertrain Technology	Battery Electric	Declared Unladen Weight (kg)	13026	Equivalent test passengers	40 passengers
Powertrain Configuration	Direct Drive	Gross Weight (kg)	19500	Measured Unladen Weight	N/A kg
Zero Emission Heating	Heat Pump	GVW Check	OK	Number of consecutive tests completed	N/A Tests
Battery Specification		Charging and Refuelling Capability		Hydrogen Specification	
Battery Manufacturer	Impact Clean Power Technology	Plug Type	CCS2 & OppCharge	Fuel Cell Manufacturer	N/A
Battery Chemistry	NMC	Max Charge Capability (kW)	Up to 150kW/300 kW	Fuel Cell Power Rating (kW)	N/A
Battery Installed Capacity (kWh)	354	Charger Compatibility	DC	Hydrogen Storage Capacity (kg)	N/A
Battery Usable Capacity (kWh)*	312	Charge time from 20-80% SOC**	2-4 hours	Hydrogen Storage Pressure (bar)	N/A

\* Recommended manufacturer guideline, subject to warranty

\*\* Based on manufacturer estimate

### Declared fuel, properties and source plus carbon conversion factors

Well-to-Tank Factor:	Electricity	72.65 g CO <sub>2</sub> e / MJ	Fuel Provider	UK market standard	WTT evidence	DBEIS Conversion 2022
Well-to-Tank Factor:	Hydrogen	N/A g CO <sub>2</sub> e / MJ	Capacity of Tanker (kg)	N/A	Fuel Type / Pathway	UK Grid Electricity
Energy Density	Hydrogen	120 MJ / kg	Transport Distance of Hydrogen (km)	N/A	Energy Source	UK Grid

### Emissions and Energy consumption results from approved test facility - Average 4 tests

Test Phase	HC (g/km)	CO (g/km)	NOx (g/km)	PM (g/km)	CO <sub>2</sub> (g/km)	CH <sub>4</sub> (g/km)*	N <sub>2</sub> O (g/km)*	Total Energy Consumption (kWh)	Vehicle Energy Consumption (kWh/km)	Grid Electrical Energy Consumption (kWh/ 100km)
Outer Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.90	0.91	113.75
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.10	1.22	152.50
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.70	0.77	96.25
LBC Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.00	1.00	125.00
UK BUS Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.70	0.90	112.50

### Zero Emissions (Z.E.) Range: Energy consumption and charging efficiency

Test Charger Used	22 kW	Total measured energy consumed on vehicle (kWh) <sup>1</sup>	N/A	Max ZE Range at 100% SOC (km)	346
Hydrogen Energy Over Test (kWh)	N/A	Measured grid energy during charging (kWh)	N/A	Max ZE Range at 80% SOC (km)	277
Hydrogen Delivered to Vehicle (kg)	N/A	Grid-to-Wheel efficiency (%) <sup>2</sup>	80%	Test Distance Travelled (km)	N/A

<sup>1</sup> Total measured energy may include energy used during the 23 minute warmup, this is needed for charge efficiency calculation.

<sup>2</sup> Grid to Wheel efficiency represents the total energy losses between the grid and the wheels of the bus.

Calculated total Well-to-Wheel GHG CO <sub>2</sub> equivalent emissions over test					Data Generated by (On behalf of Test facility): Date:	
Test Phase	Fuel Energy (MJ / km)	Fuel WTT*GHG Emissions (g CO <sub>2</sub> e / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO <sub>2</sub> e / km)	Data Approved by: Date:	
Outer Urban	N/A	N/A	4.10	297.50		
Inner Urban	N/A	N/A	5.49	398.85		
Rural	N/A	N/A	3.47	251.73		
LBC Average	N/A	N/A	4.50	326.93		
UK BUS Average	N/A	N/A	4.05	294.23		

### Zero Emission Bus Certificate Summary

Test Vehicle			Average Euro VI Diesel Equivalent		
Greenhouse Gas Emissions: Well-to-Wheel	294.2	g CO2e / km	Average Diesel GHG Emissions Equivalent	1365	g CO2e / km
WTW CO2 per passenger km (@ Max Pass Capacity)	3.1	g CO2e/pass km	WTW CO2 per passenger km (@ Max Pass Capacity)	14.5	g CO2e/pass km
Overall Zero Emission Bus Performance					
WTW GHG saving	1071.2	g CO2e / km	Maximum Theoretical Zero Emission Range (km)	346.1	
% WTW GHG saving	78%	g CO2e / km	Vehicle Energy Consumption (kWh/ km)	0.90	
Approved as Zero Emission Bus? (50% GHG saving or more)			YES		

\* WTT : Well-to-Tank

\*\* TTW : Tank-to-Wheel

\*\*\* WTW : Well-to Wheel

<b>COMMENTS:</b> LBC = London Bus Cycle - Inner & Outer Urban phases of UKBC only. Certificate generated using simulated data from AVL Cruise M multi-physics simulation tool. Simulated certificate valid until 31/12/23 - following receipt of purchase order number for physical chassis dynamometer test. Results to be replaced from valid UKBC tests. Certificate will become invalid. Charger efficiency based on existing certified ADL E400EV and E200EV.	Heating Requirement		Cell	Lower Saloon	Upper Saloon
	Target Temperatures ±2 (°C) :		10	17	17
	Average Temperatures across testing (°C)		N/A	N/A	N/A

Test Numbers:					
Certificate approved by:			Certificate Approved by:		
On behalf of Bus manufacturer		Jamie Wilson 04/05/2023	On behalf of DfT / Zemo Partnership		Tim Griffen 04.05.2023