

Zero Emission Bus Certificate

Customer:	Alexander Dennis			DYNAMOMETER SETTINGS		
Customer Address:	Cameron House, Priorswood Pl, Skelmersdale, WN8 9QB	Telematics Capability	Yes	Test Weight	15818	kg
Test Purpose:	Zero Emission Bus Testing	Maximum Speed (km/h)	80 km/h	F ⁰	-309.61	N
Vehicle Manufacturer:	Alexander Dennis / BYD	Seated Capacity	67	F ¹	-2.3179	N/kmh
Vehicle Model Name:	E400EV (LF69UXJ)	Passenger Capacity	85	F ²	0.1948	N/kmh ²
Powertrain Technology	Battery Electric	Declared Unladen Weight (kg)	13270	Equivalent test passengers	33.5	passengers
Powertrain Configuration	Direct Drive	Gross Weight (kg)	19500	Measured Unladen Weight	13540	kg
Zero Emission Heating	Heat Pump	GVW Check	OK	Number of consecutive tests completed	4	Tests
Battery Specification		Charging and Refuelling Capability		Hydrogen Specification		
Battery Manufacturer	BYD	Plug Type	Dual AC/CCS2/OppCharge	Fuel Cell Manufacturer	N/A	
Battery Chemistry	LFP	Max Charge Capability (kW)	80kW/112kW/300 kW	Fuel Cell Power Rating (kW)	N/A	
Battery Installed Capacity (kWh)	382	Charger Compatibility	AC / DC	Hydrogen Storage Capacity (kg)	N/A	
Battery Usable Capacity (kWh)*	306	Charge time from 20-80% SOC**	1-5 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 _{2e} / MJ	Fuel Provider	UK market standard	WTT evidence	DBEIS Conversion 2022
Well-to-Tank Factor:	Hydrogen	N/A	g CO _{2e} / 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 ₂ (g/km)	CH ₄ (g/km)*	N ₂ 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	6.56	1.02	125.02
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.16	1.26	154.93
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.26	0.71	87.38
LBC Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.72	1.09	133.39
UK BUS Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14.98	0.92	112.57

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

Test Charger Used	22 kW	Total measured energy consumed on vehicle (kWh) ¹	75.00	Max ZE Range at 100% SOC (km)	333
Hydrogen Energy Over Test (kWh)	N/A	Measured grid energy during charging (kWh)	92.00	Max ZE Range at 80% SOC (km)	266
Hydrogen Delivered to Vehicle (kg)	N/A	Grid-to-Wheel efficiency (%) ²	82%	Test Distance Travelled (km)	82

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

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

Calculated total Well-to-Wheel GHG CO₂ equivalent emissions over test

Test Phase	Fuel Energy (MJ / km)	Fuel WTT*GHG Emissions (g CO _{2e} / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO _{2e} / km)
Outer Urban	N/A	N/A	4.50	326.97
Inner Urban	N/A	N/A	5.58	405.20
Rural	N/A	N/A	3.15	228.53
LBC Average	N/A	N/A	4.80	348.87
UK BUS Average	N/A	N/A	4.05	294.41

Data Generated by (On behalf of Test facility): Date:

Data Approved by: Date:

Zero Emission Bus Certificate Summary

Test Vehicle	Average Euro VI Diesel Equivalent
Greenhouse Gas Emissions: Well-to-Wheel	294.4 g CO _{2e} / km
WTW CO ₂ per passenger km (@ Max Pass Capacity)	3.5 g CO _{2e} /pass km
Overall Zero Emission Bus Performance	
WTW GHG saving	1011.9 g CO _{2e} / km
% WTW GHG saving	77% g CO _{2e} / km
Maximum Theoretical Zero Emission Range (km)	
333.0	
Vehicle Energy Consumption (kWh/ km)	
0.92	
Approved as Zero Emission Bus? (50% GHG saving or more)	
YES	

* WTT : Well-to-Tank

** TTW : Tank-to-Wheel

*** WTW : Well-to Wheel

COMMENTS: Emission results marked in red are below detection levels. LBC = London Bus Cycle - Inner & Outer Urban phases of UKBC only. Due to an equipment error, one of the two HV cables was not measured correctly. Data for this certificate has been generated based on the correctly measured HV cable multiplied by 2.

Heating Requirement	Cell	Lower Saloon	Upper Saloon
Target Temperatures ±2 (°C) :	10	17	17
Average Temperatures across testing (°C)	9.98	16.85	16.95

Test Numbers: 20220325_1404, 20220325_1621, 20220325_1735, 20220325_1856

Certificate approved by: Jamie Wilson
On behalf of Bus manufacturer
04/05/2023

Certificate Approved by: Tim Griffen
On behalf of DfT / Zemo Partnership
21.03.2023