

# Zero Emission Bus Certificate

<b>Customer:</b> Wrightbus				<b>DYNAMOMETER SETTINGS</b>		
<b>Customer Address:</b>	201 Galgorm Rd, Ballymena, County Antrim, BT42 1SA	<b>Telematics Capability</b>	Yes	<b>Test Weight</b>	15500	kg
<b>Test Purpose:</b>	Zero Emission Bus Testing	<b>Maximum Speed (km/h)</b>	80 km/h	<b>F<sup>0</sup></b>	-394.24	N
<b>Vehicle Manufacturer:</b>	Wrightbus	<b>Seated Capacity</b>	60	<b>F<sup>1</sup></b>	0.9810	N/kmh
<b>Vehicle Model Name:</b>	Streetdeck Electroliner	<b>Passenger Capacity</b>	87	<b>F<sup>2</sup></b>	0.098	N/kmh <sup>2</sup>
<b>Powertrain Technology</b>	Battery Electric	<b>Declared Unladen Weight (kg)</b>	13385	<b>Equivalent test passengers</b>	30	passengers
<b>Powertrain Configuration</b>	Direct Drive	<b>Gross Weight (kg)</b>	19500	<b>Measured Unladen Weight</b>	13149	kg
<b>Zero Emission Heating</b>	Heat Pump	<b>GVW Check</b>	OK	<b>Number of consecutive tests completed</b>	4	Tests
<b>Battery Specification</b>		<b>Charging and Refuelling Capability</b>		<b>Hydrogen Specification</b>		
<b>Battery Manufacturer</b>	Forsee Power	<b>Plug Type</b>	CCS2 & OppCharge	<b>Fuel Cell Manufacturer</b>	N/A	
<b>Battery Chemistry</b>	NMC	<b>Max Charge Capability (kW)</b>	Up to 150kW/360 kW	<b>Fuel Cell Power Rating (kW)</b>	N/A	
<b>Battery Installed Capacity (kWh)</b>	454	<b>Charger Compatibility</b>	DC	<b>Hydrogen Storage Capacity (kg)</b>	N/A	
<b>Battery Usable Capacity (kWh)*</b>	363	<b>Charge time from 20-80% SOC**</b>	1-6 hours	<b>Hydrogen Storage Pressure (bar)</b>	N/A	

\* Recommended manufacturer guideline, subject to warranty

\*\* Based on manufacturer estimate

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

<b>Well-to-Tank Factor: Electricity</b>	72.65	<b>g CO<sub>2e</sub> / MJ</b>	<b>Fuel Provider</b>	UK market standard	<b>WTT evidence</b>	DBEIS Conversion 2022
<b>Well-to-Tank Factor: Hydrogen</b>	N/A	<b>g CO<sub>2e</sub> / MJ</b>	<b>Capacity of Tanker (kg)</b>	N/A	<b>Fuel Type / Pathway</b>	UK Grid Electricity
<b>Energy Density Hydrogen</b>	120	<b>MJ / kg</b>	<b>Transport Distance of Hydrogen (km)</b>	N/A	<b>Energy Source</b>	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	5.07	0.78	90.99
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.65	1.05	122.49
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.69	0.63	73.50
LBC Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.72	0.86	100.33
<b>UK BUS Average</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.41	0.75	81.07

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

<b>Test Charger Used</b>	40kW	<b>Total measured energy consumed on vehicle (kWh)<sup>1</sup></b>	62.00	<b>Max ZE Range at 100% SOC (km)</b>	484
<b>Hydrogen Energy Over Test (kWh)</b>	N/A	<b>Measured grid energy during charging (kWh)</b>	67.00	<b>Max ZE Range at 80% SOC (km)</b>	387
<b>Hydrogen Delivered to Vehicle (kg)</b>	N/A	<b>Grid-to-Wheel efficiency (%)<sup>2</sup></b>	86%	<b>Test Distance Travelled (km)</b>	65

<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

Test Phase	Fuel Energy (MJ /km)	Fuel WTT*GHG Emissions (g CO <sub>2e</sub> / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO <sub>2e</sub> / km)
Outer Urban	N/A	N/A	3.28	237.98
Inner Urban	N/A	N/A	4.41	320.36
Rural	N/A	N/A	2.65	192.23
LBC Average	N/A	N/A	3.61	262.40
<b>UK BUS Average</b>	N/A	N/A	2.92	212.03

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	
<b>Greenhouse Gas Emissions: Well-to-Wheel</b>	212.0 g CO <sub>2e</sub> / km	<b>Average Diesel GHG Emissions Equivalent</b>	1300 g CO <sub>2e</sub> / km
<b>WTW CO<sub>2</sub> per passenger km (@ Max Pass Capacity)</b>	2.4 g CO <sub>2e</sub> /pass km	<b>WTW CO<sub>2</sub> per passenger km (@ Max Pass Capacity)</b>	14.9 g CO <sub>2e</sub> /pass km
Overall Zero Emission Bus Performance			
<b>WTW GHG saving</b>	1087.5 g CO <sub>2e</sub> / km	<b>Maximum Theoretical Zero Emission Range (km)</b>	484.3
<b>% WTW GHG saving</b>	84% g CO <sub>2e</sub> / km	<b>Vehicle Energy Consumption (kWh/ km)</b>	0.75
<b>Approved as Zero Emission Bus? (50% GHG saving or more)</b>		<b>YES</b>	

\* WTT : Well-to-Tank

\*\* TTW : Tank-to-Wheel

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

COMMENTS:	Heating Requirement		
	Cell	Lower Saloon	Upper Saloon
	<b>Target Temperatures ±2 (°C) :</b>	10	17
<b>Average Temperatures across testing (°C)</b>	10.01	18.29	16.40

**Test Numbers:** 20220412\_1038\_2xUKBC, 20220412\_1247\_UKBC, 20220412\_1406\_2xUKBC

Certificate approved by: Brian Maybin  
On behalf of Bus manufacturer 29.03.2023

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