

# Zero Emission Bus Certificate

Customer:	Wrightbus	<b>DYNAMOMETER SETTINGS</b>			
Customer Address:	201 Galgorm Rd, Ballymena, County Antrim, BT42 1SA	Telematics Capability	Yes	Test Weight	15504 kg
Test Purpose:	Zero Emission Bus Testing	Maximum Speed (km/h)	80 km/h	F°	650.52 N
Vehicle Manufacturer:	Wrightbus	Seated Capacity	39	F <sup>1</sup>	17.5328 N/kmh
Vehicle Model Name:	GB Kite Electroliner AU062	Passenger Capacity	78	F <sup>2</sup>	-0.03103 N/kmh <sup>2</sup>
Powertrain Technology:	Battery Electric	Declared Unladen Weight (kg)	14103	Equivalent test passengers	19.5 passengers
Powertrain Configuration:	Direct Drive	Gross Weight (kg)	19500	Measured Unladen Weight	13660 kg
Zero Emission Heating:	Heat Pump	GVW Check	OK	Number of consecutive tests completed	4 Tests
<b>Battery Specification</b>		<b>Charging and Refuelling Capability</b>		<b>Hydrogen Specification</b>	
Battery Manufacturer	Forsee Power	Plug Type	CCS2 & OppCharge	Fuel Cell Manufacturer	N/A
Battery Chemistry	NMC	Max Charge Capability (kW)	Up to 150kW/360 kW	Fuel Cell Power Rating (kW)	N/A
Battery Installed Capacity (kWh)	567	Charger Compatibility	DC	Hydrogen Storage Capacity (kg)	N/A
Battery Usable Capacity (kWh)*	454	Charge time from 20-80% SOC**	2-6 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	4.56	0.70	81.05
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.29	0.90	105.20
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.28	0.58	66.94
LBC Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.86	0.76	87.79
<b>UK BUS Average</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11.14	0.67	<b>78.40</b>

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

Test Charger Used	40kW	Total measured energy consumed on vehicle (kWh) <sup>1</sup>	45.00	Max ZE Range at 100% SOC (km)	673
Hydrogen Energy Over Test (kWh)	N/A	Measured grid energy during charging (kWh)	104.00	Max ZE Range at 80% SOC (km)	538
Hydrogen Delivered to Vehicle (kg)	N/A	Grid-to-Wheel efficiency (%) <sup>2</sup>	86%	Test Distance Travelled (km)	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>2</sub> e / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO <sub>2</sub> e / km)
Outer Urban	N/A	N/A	2.92	211.99
Inner Urban	N/A	N/A	3.79	275.14
Rural	N/A	N/A	2.41	175.07
LBC Average	N/A	N/A	3.16	229.62
<b>UK BUS Average</b>	N/A	N/A	2.82	205.05

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	205.1	g CO <sub>2</sub> e / km	Average Diesel GHG Emissions Equivalent	1215 g CO <sub>2</sub> e / km
WTW CO <sub>2</sub> per passenger km (@ Max Pass Capacity)	2.6	g CO <sub>2</sub> e/pass km	WTW CO <sub>2</sub> per passenger km (@ Max Pass Capacity)	15.6 g CO <sub>2</sub> e/pass km

### Overall Zero Emission Bus Performance

WTW GHG saving	1009.7	g CO <sub>2</sub> e / km	Maximum Theoretical Zero Emission Range (km)	672.7
% WTW GHG saving	83%	g CO <sub>2</sub> e / km	Vehicle Energy Consumption (kWh/ km)	0.67

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> Customer requested UTAC fit a bracket restricting the flow of coolant in the system to the middle saloon heater, as per production intent.	<b>Heating Requirement</b>	Cell	Lower Saloon	Upper Saloon
	Target Temperatures ±2 (°C) :	10	17	17
	Average Temperatures across testing (°C)	10.03	16.72	N/A

**Test Numbers:** 20230503\_0825\_2xUKBC, 20230503\_1053\_2xUKBC

 Certificate approved by: Brian Maybin  
 On behalf of Bus manufacturer: 09.05.2023

 Certificate Approved by:  
 On behalf of DfT / Zemo Partnership



 Tim Griffen  
 05.05.2023