

## Zero Emission Bus Certificate

<b>Customer:</b> Mellor				<b>DYNAMOMETER SETTINGS</b>		
<b>Customer Address:</b>	Miall Street, Rochdale, Gt. Manchester, OL11 1HY	<b>Telematics Capability</b>	Yes	<b>Test Weight</b>	5681	kg
<b>Test Purpose:</b>	Zero Emission Bus Testing	<b>Maximum Speed (km/h)</b>	75 km/h	<b>F°</b>	-164.54	N
<b>Vehicle Manufacturer:</b>	Mellor	<b>Seated Capacity</b>	9	<b>F<sup>1</sup></b>	-0.1658	N/kmh
<b>Vehicle Model Name:</b>	Sigma 7, SA9S1G07J21474001	<b>Passenger Capacity</b>	30	<b>F<sup>2</sup></b>	0.12896	N/kmh <sup>2</sup>
<b>Powertrain Technology:</b>	Battery Electric	<b>Declared Unladen Weight (kg)</b>	5700	<b>Equivalent test passengers</b>	7.5	passengers
<b>Powertrain Configuration:</b>	Direct Drive	<b>Gross Weight (kg)</b>	8000	<b>Measured Unladen Weight</b>	5681	kg
<b>Zero Emission Heating:</b>	PTC Heaters	<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>	CATL	<b>Plug Type</b>	DC CCS2	<b>Fuel Cell Manufacturer</b>	N/A	
<b>Battery Chemistry</b>	NMC	<b>Max Charge Capability (kW)</b>	Up to 100kW	<b>Fuel Cell Power Rating (kW)</b>	N/A	
<b>Battery Installed Capacity (kWh)</b>	142	<b>Charge Compatibility</b>	DC	<b>Hydrogen Storage Capacity (kg)</b>	N/A	
<b>Battery Usable Capacity (kWh)*</b>	114	<b>Charge time from 20-80% SOC**</b>	2-4 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:</b> Electricity	72.65	g CO <sub>2</sub> e / MJ	<b>Fuel Provider</b>	UK market standard	<b>WTT evidence</b>	DBEIS Conversion 2022
<b>Well-to-Tank Factor:</b> Hydrogen	N/A	g CO <sub>2</sub> e / MJ	<b>Capacity of Tanker (kg)</b>	N/A	<b>Fuel Type / Pathway</b>	UK Grid Electricity
<b>Energy Density</b> Hydrogen	N/A	MJ / kg	<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	4.02	0.61	65.59
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.07	0.81	88.78
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.31	0.45	49.01
<b>LBC Average</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.10	0.67	73.57
<b>UK BUS Average</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.41	0.57	62.55

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

<b>Test Charger Used</b>	22 kW	<b>Total measured energy consumed on vehicle (kWh)<sup>1</sup></b>	38.00	<b>Max ZE Range at 100% SOC (km)</b>	197
<b>Hydrogen Energy Over Test (kWh)</b>	N/A	<b>Measured grid energy during charging (kWh)</b>	41.00	<b>Max ZE Range at 80% SOC (km)</b>	158
<b>Hydrogen Delivered to Vehicle (kg)</b>	N/A	<b>Grid-to-Wheel efficiency (%)<sup>2</sup></b>	93%	<b>Test Distance Travelled (km)</b>	66

<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	2.36	171.55
Inner Urban	N/A	N/A	3.20	232.20
Rural	N/A	N/A	1.76	128.18
<b>LBC Average</b>	N/A	N/A	1.76	128.18
<b>UK BUS Average</b>	N/A	N/A	2.65	192.41

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		
<b>Greenhouse Gas Emissions: Well-to-Wheel</b>	192.4	g CO <sub>2</sub> e / km	<b>Average Diesel GHG Emissions Equivalent</b> 763 g CO <sub>2</sub> e / km
<b>WTW CO<sub>2</sub> per passenger km (@ Max Pass Capacity)</b>	6.4	g CO <sub>2</sub> e/pass km	<b>WTW CO<sub>2</sub> per passenger km (@ Max Pass Capacity)</b> 25.4 g CO <sub>2</sub> e/pass km
<b>Overall Zero Emission Bus Performance</b>			
<b>WTW GHG saving</b>	570.2	g CO <sub>2</sub> e / km	<b>Maximum Theoretical Zero Emission Range (km)</b> 197.0
<b>% WTW GHG saving</b>	75%	g CO <sub>2</sub> e / km	<b>Vehicle Energy Consumption (kWh/ km)</b> 0.57
<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:** Emission results marked in red are below detection levels. LBC = London Bus Cycle - Inner & Outer Urban phases of UKBC only.

Heating Requirement	Cell	Lower Saloon	Upper Saloon
<b>Target Temperatures ±2 (°C) :</b>	10	17	17
<b>Average Temperatures across testing (°C)</b>	10.00	21.68	N/A

**Test Numbers:** 20220315\_1222, 20220315\_1519, 20220315\_1714, 20220315\_2000

 Certificate approved by: John Randerson  
 On behalf of Bus manufacturer 23 Mar 2023



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