

Zero Emission Bus Certificate

Customer:	Mellor			DYNAMOMETER SETTINGS		
Customer Address:	Miall Street, Rochdale, Gt. Manchester, OL11 1HY	Telematics Capability	Yes	Test Weight	11450	kg
Test Purpose:	Zero Emission Bus Testing	Maximum Speed (km/h)	70 km/h	F ⁰	-156.82	N
Vehicle Manufacturer:	Mellor	Seated Capacity	31	F ¹	-4.1830	N/kmh
Vehicle Model Name:	Sigma 10, MX22 LFY	Passenger Capacity	54	F ²	0.20797	N/kmh ²
Powertrain Technology:	Battery Electric	Declared Unladen Weight (kg)	10500	F ³	0.000000	N/kmh ³
Powertrain Configuration:	Direct Drive	Gross Weight (kg)	16500	Equivalent test passengers	15.5	passengers
Zero Emission Heating:	PTC Heaters	GVW Check	OK	Measured Unladen Weight	10276	kg
Battery Specification		Charging and Refuelling Capability		Hydrogen Specification		
Battery Manufacturer	CATL	Plug Type	DC	Fuel Cell Manufacturer	N/A	
Battery Chemistry	LFP	Max Charge Capability (kW)	Up to 100kW	Fuel Cell Power Rating (kW)	N/A	
Battery Installed Capacity (kWh)	260	Charger Compatibility	DC	Hydrogen Storage Capacity (kg)	N/A	
Battery Usable Capacity (kWh)*	210	Charge time from 20-80% SOC	2-6 hours	Hydrogen Storage Pressure (bar)	N/A	

* Recommended manufacturer guideline, subject to warranty

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	5.46	0.84	98.27
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.83	1.12	130.80
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.98	0.54	63.10
LBC Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.28	0.92	107.40
UK BUS Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.27	0.75	87.46

Zero Emissions (Z.E.) Range: Energy consumption and charging efficiency					
Test Charger Used	22 kW	Total measured energy consumed on vehicle (kWh) ¹	88.00	Max ZE Range at 100% SOC (km)	281
Hydrogen Energy Over Test (kWh)	N/A	Measured grid energy during charging (kWh)	103.00	Max ZE Range at 80% SOC (km)	224
Hydrogen Delivered to Vehicle (kg)	N/A	Grid-to-Wheel efficiency (%) ²	85%	Test Distance Travelled (km)	66

¹ Total measured energy includes 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 CO ₂ 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 _{2e} / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO _{2e} / km)	Data Approved by: _____ Date: _____	
Outer Urban	N/A	N/A	3.54	257.01		
Inner Urban	N/A	N/A	4.71	342.08		
Rural	N/A	N/A	2.27	165.03		
LBC Average	N/A	N/A	3.87	280.90		
UK BUS Average	N/A	N/A	3.15	228.75		

Zero Emission Bus Certificate Summary							
Test Vehicle			Average Euro VI Diesel Equivalent				
Greenhouse Gas Emissions: Well-to-Wheel		228.8	g CO _{2e} / km	Average Diesel GHG Emissions Equivalent		989	g CO _{2e} / km
WTW CO ₂ per passenger km (@ Max Pass Capacity)		4.2	g CO _{2e} /pass km	WTW CO ₂ per passenger km (@ Max Pass Capacity)		18.3	g CO _{2e} /pass km
Overall Zero Emission Bus Performance							
WTW GHG saving		759.9	g CO _{2e} / km	Maximum Theoretical Zero Emission Range (km)		281.0	
% WTW GHG saving		77%	g CO _{2e} / km	Vehicle Energy Consumption (kWh/ km)		0.75	
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. Warm-up conducted prior to each set of 2xUKBC (15mins @ 35km/h steady state), energy consumed during the warm-up has been included in the total energy consumed. Driver manually controlled temperature in cabin to maintain interior temperature at approximately 17°C.	Heating Requirement		Cell	Lower Saloon	Upper Saloon
	Target Temperatures ±2 (°C) :		10	17	n/a
	Average Temperatures across testing (°C)		10.00	19.61	n/a

Test Numbers: 20220819_1511_2xUKBC, 20220819_1808_2xUKBC

Certificate approved by: On behalf of Bus manufacturer	John Randerson 23 Mar 2023	Certificate Approved by: On behalf of DfT / Zemo Partnership	Tim Griffen 21.03.2023
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