

Zero Emission Bus Certificate

Customer: CaetanoBus, S.A.				DYNAMOMETER SETTINGS	
Customer Address: 4431-901 Vila Nova de Gaia	Telematics Capability	Yes		Test Weight	14375 kg
Test Purpose: Zero Emission Bus Testing	Maximum Speed (km/h)	80 km/h		F ¹	346.64 N
Vehicle Manufacturer: CaetanoBus	Seated Capacity	31		F ¹	-10.2804 N/kmh
Vehicle Model Name: e.CityGold	Passenger Capacity	65		F ²	0.52 N/kmh ²
Powertrain Technology: Battery Electric	Declared Unladen Weight (kg)	13530		F ³	-0.004367 N/kmh ³
Powertrain Configuration: Elbe Direct Drive	Gross Weight (kg)	17950		Equivalent test passengers	
Zero Emission Heating: Heat Pump	GVW Check	OK		Measured Unladen Weight (kg)	
				16	
				13195	
Battery Specification		Charging and Refuelling Capability		Hydrogen Specification	
Battery Manufacturer	Forsee Power	Plug Type	CCS 2	Fuel Cell Manufacturer	N/A
Battery Chemistry	NMC	Max Charge Capability (kW)	Up to 150kW	Fuel Cell Power Rating (kW)	N/A
Battery Installed Capacity (kWh)	385	Charger Compatibility	DC	Hydrogen Storage Capacity (kg)	N/A
Battery Usable Capacity (kWh)[*]	308	Charge time from 20-80% SOC	2-4 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	80.92	g CO ₂ e / MJ	Fuel Provider	UK market standard	WTT evidence	DBEIS Conversion 2021
Well-to-Tank Factor: Hydrogen	N/A	g CO ₂ 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	Hydrogen Production 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)*	Vehicle Energy Consumption (kWh)	Grid Electrical Energy Consumption (kWh/ 100km)
Outer Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.53	133.86
Inner Urban	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.98	157.88
Rural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.64	100.25
LBC Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.51	140.57
UK BUS Average	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.15	122.27

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

Test Charger Used	22 kW	Total measured energy consumed on vehicle (kWh)¹	90.9	Max ZE Range at 100% SOC (km)	331
Hydrogen Energy Over Test (kWh)	N/A	Measured grid energy during charging (kWh)	119.4	Max ZE Range at 80% SOC (km)	265
Hydrogen Delivered to Vehicle (kg)	N/A	Grid-to-Wheel efficiency (%)²	76%	Test Distance Travelled (km)	65

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, charger, drivetrain and the wheels of the bus.

Calculated total Well-to-Wheel GHG CO₂ equivalent emissions

Test Phase	Fuel Energy (MJ / km)	Fuel WTT*GHG Emissions (g CO ₂ e / km)	Electrical Energy (MJ / km)	Electricity WTT* GHG Emissions (g CO ₂ e / km)
Outer Urban	N/A	N/A	4.82	389.95
Inner Urban	N/A	N/A	5.68	459.94
Rural	N/A	N/A	3.61	292.05
LBC Average	N/A	N/A	5.06	409.48
UK BUS Average	N/A	N/A	4.40	356.18

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	
GHG Well-to-Wheel	356.2 g CO ₂ e / km	Average Diesel Equivalent	1092 g CO ₂ e / km
WTW CO₂ per passenger km (@ Max Pass Capacity)	5.5 g CO ₂ e/pass km	WTW CO₂ per passenger km (@ Max Pass Capacity)	16.8 g CO ₂ e/pass km
Overall Zero Emission Bus Performance			
WTW GHG saving	736.1 g CO ₂ e / km	Maximum Theoretical Zero Emission Range (km)	331
% WTW GHG saving	67% g CO ₂ e / km	Vehicle Energy Consumption (kWh/ km)	1.2
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.

	Cell	Lower Saloon	Upper Saloon
Target Temperatures ±2 (°C) :	10	17	N/A
Average Temperatures across testing (°C)	9.40	18.58	N/A

Test Numbers: ML02019187 (24-June-20), ML02019188 (24-June-20), ML02019189 (24-June-20), ML02019189 (24-June-20)

Certificate approved by: Tony Tomsett
On behalf of Bus manufacturer
14.04.22

Certificate Approved by:
On behalf of DIT / Zemo Partnership

Daniel Hayes
7.04.2022

Dan Hayes