All-Electric Conversion of the USPS Long Life Vehicle (LLV)

Vehicle: USPS eLLV Conversion by *Quantum Technologies*

Vehicle ID: 3300987
Seatbelt Positions: One (right hand drive)
Standard Features:
- Cabin Heat (gasoline fired heater)
- Power Steering
- Power Brakes (vacuum assist)
- Regenerative Braking
- Steel wheels

Additional Features:
- Low Rolling Resistance Tires
- Solar Panels on Roof
- LED Head Lights and Tail Lights

Vehicle Specifications

Battery
Type: Li-Ion
Pack Locations: Under hood above powertrain
Nominal System Voltage: 333 V
Rated Capacity (C/3): 40 Ah
Cooling Method: Glycol / Water mix

Powertrain
Motor Type: DC Brushless
Number of Motors: One
Motor Cooling Type: Glycol / Water mix
Drive Wheels: Rear Wheel Drive
Transmission: None (gear ratio only in rear axle)

Charger
Location: Underhood
Charger Port: Driver's side, front quarter panel
Type: Conductive (J1772 connector)
Input Voltage(s): 120 or 240 VAC

Chassis
Aluminum Body on Steel Frame
Rear Suspension: Solid Axle with Leaf Springs
Front Suspension: Dual A-arm with Coil Springs

Weights
Design Curb Weight: 3250 lbs
Delivered Curb Weight: **3310 lbs**[7]
Distribution F/R: 55.2/44.8%
GVWR: 4450 lbs
Max Payload: **940 lbs** + 200 lbs driver[1]
Performance Goal Payload: 1000 lbs + 200 lbs driver

Dimensions
Wheelbase: 100.5 inches
Length: 175.5 inches
Width: 76 inches
Height: 85 inches

Tires
Tire Mfg: Bridgestone
Tire Model: Ecopia EP100
Tire Size: P195/65R15
Tire Pressure F/R: 35/35 psi[2]

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Performance Statistics

Acceleration 0-50 Mph (332 Lbs Payload)

At 90% SOC: 12.9 sec

At 50% SOC: 12.7 sec

Max. Battery Power: 66.4 kW

Acceleration 0-50 Mph (1000 Lbs Payload)

At 90% SOC: 16.4 sec

At 50% SOC: 17.7 sec

Max. Battery Power: 61.8 kW

Braking From 60 Mph (332 Lbs Payload)

Controlled Dry: 199 feet

Course Deviation: 0.0 feet

Braking From 60 Mph (1000 Lbs Payload)

Controlled Dry: n/a

Course Deviation: 0.0 feet

Performance Goal: 216 feet

Gradeability (Calculated) (332 Lbs Payload)

Maximum Speed @ 3%: 64.7 mph

Maximum Speed @ 6%: 57.3 mph

Maximum Grade: 27.7%

Maximum Speed @ 50% Soc (332 Lbs Payload)

At 1/4 Mile: 63.9 mph

At 1 Mile: 66.8 mph

Constant Speed Range @ 45 Mph[6] (332 Lbs Payload)

Range: 31.1 miles

Energy Used: 11.4 DC kWh

Average Battery Power: 13.8 kW

Recharge Energy: 14.5 AC kWh @ 240 VAC

Efficiency: 367 DC Wh/mile

Efficiency: 467.3 AC Wh/mile

Constant Speed Range @ 60 Mph[6] (332 Lbs Payload)

Range: 23.5 miles

Energy Used: 11.3 DC kWh

Average Battery Power: 19.4 kW

Recharge Energy: 14.3 AC kWh @ 240 VAC

Efficiency: 481 DC Wh/mile

Efficiency: 608 AC Wh/mile

Charger Level 1 (@120 Vac / 13A)

Time to Fully Recharge: 10 hours

Charger Level 2 (@240 Vac / 13A)

Time to Fully Recharge: 5 hours

Conversion Co. 25 Mile Delivery Cycle[8,9] (1000 lbs payload)

Driving Distance: 28.5 miles

Energy Used: 12.1 DC kWh

Recharge Energy: 14.8 AC kWh @120VAC

Efficiency: 424 DC Wh/mile

Efficiency: 519 AC Wh/mile

USPS Delivery 25 Mile Cycle[5,6] (1000 Lbs Payload + 200 Lbs Driver)

Driving Distance: 15.1 miles[8]

Energy Used: 12.6 DC kWh

Recharge Energy: 16.1 AC kWh @ 120 VAC

Efficiency: 834 DC Wh/mile

Efficiency: 1063 AC Wh/mile

Driving Cycle Range (J1634)[6] (332 Lbs Payload)

Range per J1634: 36.9 miles

Energy Used: 11.4 DC kWh

Recharge Energy: 14.9 AC kWh @ 120 VAC

Efficiency (J1634): 403 AC Wh/mile

Efficiency UDDS: 277 DC Wh/mile

Efficiency HWFET: 326 DC Wh/mile

Test Notes:

1. Design Payload Value is 1000 lbs plus one 200 lbs driver (no passengers) given the original LLV GVWR of 4450 lbs.

2. DOT Side-wall Tire Air Pressure Rating

4. At test termination, vehicle was still able to maintain the required drive schedule.

5. USPS Delivery Cycle: 8 miles city, 6 miles freeway, and 11 miles stop/go with 700 stops.

6. At test termination, vehicle was not able to maintain the required drive schedule.

7. The optional solar panels weigh approximately 100 lbs, for a total delivered curb weight of 3310 lbs.

8. This vehicle achieved a range of 25 miles over a 25 mile delivery route cycle supplied by the conversion company which meets the USPS Statement of Work requirements.

9. Conversion Company 25 Mile Delivery Cycle: 14 miles of city & hwy driving, 11 miles stop/go. This cycle meets the USPS SOW criteria for delivery range. The vehicle was designed to meet the range for this cycle. The USPS Delivery 25 Mile Dynamometer Cycle had not been provided to the Conversion Company when the battery pack was designed.

Values in **Red** indicate the Performance Goal was not met.

USPS Requirement Specifications

1. Vehicle has a payload of at least 1000 pounds.

2. Seating capacity is one (1) driver occupant.

3. The cargo space has not been intruded upon by the electrical conversion components or materials.

4. The vehicle consumes no liquid fuel for propulsion.

5. The vehicle has a parking mechanism per SAE J2344 section 4.10 Mechanical Safety to prevent unintended motion of the vehicle when placed in “P” (PARK) or when the key is removed.

6. The vehicle contains a vehicle crash sensor automatically disconnect high voltage in case of a crash.

7. The vehicle has a minimum range between charges of at least 25 miles when loaded with 1000 lbs payload and one 200 lbs driver over the specified USPS drive cycle including 8 miles of city drivng, 6 miles of freeway driving, and 11 miles of delivery driving with 700 stops.

8. The vehicle is capable of accelerating from 0 to 15 mph in 5 seconds, 0 to 50 mph in 22 seconds, and 0 to 55 mph in 35 seconds.

9. The vehicle is capable of coming to a complete stop from 60 mph in 216 feet, 30 mph in 57 feet, and 20 mph in 25 feet.

10. The vehicle manufacturer has certified the charger is capable of accepting input voltages of 110V single phase 60 Hertz alternating current service. Charger input current is compatible with a 15A branch circuit.

11. The vehicle does not contain exposed conductors, terminals, contact blocks or devices of any type that create the potential for personnel to be exposed to 50 volts or greater.

12. The vehicle will be accompanied by manuals for service, operation, maintenance, and towing

13. Propulsion power is isolated from the vehicle chassis.

14. Charging circuits are isolated from the vehicle chassis.

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