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

Vehicle: USPS eLLV Conversion by Autoport/AC Propulsion/University of Delaware

Vehicle ID: 2204700 Seatbelt Positions: One (right hand drive) Standard Features: Cabin Heat (gasoline fired heater) Power Steering (electro-hydraulic) Power Brakes (vacuum assist) Regenerative Braking Steel wheels Additional Features: Vehicle-2-Grid Capable up to 80A

Vehicle Specifications

Battery Type: Li-Ion Pack Locations: Underbody (inboard of frame rails) Nominal System Voltage: 375 V Rated Capacity (C/3): 60 Ah

Cooling Method: Forced air, conditioned with A/C (air to air exchanger)

Powertrain

Motor Type: AC Induction Number of Motors: One Motor Cooling Type: Forced air Drive Wheels: Rear Wheel Drive Transmission: Fixed Gear Reduction

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: 3408 lbs Distribution F/R: 50.4/49.6% GVWR: 4450 lbs Max Payload: 842 lbs + 200 lbs driver¹ 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: Kumho Tire Model: Solus KR2 Tire Size: P195/75R14 Tire Pressure F/R: 35/35 psi²

Performance Statistics

Acceleration 0-50 mph (332 lbs payload) At 90% SOC: 11.5 sec At 50% SOC: 12.1 sec Max. Battery Power: 71.4 kW

Acceleration 0-50 mph (1000 lbs payload) At 90% SOC: 11.7 sec At 50% SOC: 13.1 sec Max. Battery Power: 80.3 kW

Braking From 60 mph (332 lbs payload) Controlled Dry: 189 feet Course Deviation: 0.0 feet

Braking From 60 mph (1000 lbs payload) Controlled Dry: 192 feet Course Deviation: 0.0 feet Performance Goal: 216 feet

Gradeability (Calculated) (332 lbs payload) Maximum Speed @ 3%: 67.6 mph Maximum Speed @ 6%: 57.4 mph Maximum Grade: 33.5%

Maximum Speed @ 50% SOC (332 lbs payload) At 1/4 Mile: 64.4 mph At 1 Mile: 72.5 mph

Constant Speed Range @ 45 mph,⁶ (332 lbs payload) Range: 47.2 miles Energy Used: 16.0 DC kWh Average Battery Power: 14.4 kW Recharge Energy: 20.4 AC kWh @ 240 VAC Efficiency: 338 DC Wh/mile Efficiency: 432 AC Wh/mile

Constant Speed Range @ 60 mph^{3,6} (332 lbs payload) Range: 35.9 miles Energy Used: 17.5 DC kWh Average Battery Power: 23.0 kW Recharge Energy: 23.8 AC kWh @ 240 VAC Efficiency: 487 DC Wh/mile Efficiency: 663 AC Wh/mile USPS Delivery 25 Mile Cycle^{4,5} (1000 lbs payload + 200 lbs driver) Driving Distance: 25.0 miles Energy Used: 18.2 DC kWh Recharge Energy: 29.1 AC kWh @ 120 VAC Efficiency: 727 DC Wh/mile Efficiency: 1160 AC Wh/mile

Driving Cycle Range (J1634)⁶ (332 lbs payload) Range per J1634: 54.4 miles Energy Used: 18.7 DC kWh Recharge Energy: 24.3 AC kWh @ 208 VAC Efficiency (J1634): 446 AC Wh/mile Efficiency UDDS: 318 DC Wh/mile Efficiency HWFET: 385 DC Wh/mile

Charger Level 1 (@120 VAC / 13A) Time to Fully Recharge: 22 hours

Charger Level 2 (@208 VAC / 18A) Time to Fully Recharge: 6.5 hours

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. Manufacturer recommended Tire Air Pressure

3. Test was terminated due to overheating.

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.

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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