



## 1998 Toyota RAV4 EV w/NiMH

### VEHICLE SPECIFICATIONS

#### PURPOSE-BUILT VEHICLE

Base Vehicle: 1998 Toyota RAV4  
VIN: JT3GS10V0W0001009  
Seatbelt Positions: Five

#### Standard Features:

- AM/FM Stereo Radio
- Tilt Steering Wheel
- Air Conditioning (Gas Injection Heat Pump)
- Heater (Gas Injection Heat Pump)
- Front Wheel Drive
- Dual Air Bags
- Power Steering (Rack & Pinion, hydraulic)
- Power Brakes
- Four Wheel Disc Brakes
- Four Wheel Anti-Lock Brakes
- Regenerative Braking
- Power Windows
- Space Saver Spare
- Aluminum Wheels
- Low Rolling Resistance Tires

#### BATTERY

Manufacturer: Panasonic  
Type: Nickel Metal Hydride  
Number of Modules: 24  
Weight of Module: 18.75 kg  
Weight of Pack(s): 461 kg  
Pack Locations: Underbody  
Nominal Module Voltage: 12 V  
Nominal System Voltage: 288 V  
Nominal Capacity (C/3): 95 Ah

#### WEIGHTS

Design Curb Weight: 3480 lbs  
Delivered Curb Weight: 3507 lbs  
Distribution F/R: 52/48%  
GVWR: 4266 lbs  
GAWR F/R: 2138/2128 lbs  
Payload: 786 lbs<sup>1</sup>  
Performance Goal: 600 lbs

#### DIMENSIONS

Wheelbase: 94.6 inches  
Track F/R: 57.6/56.9 inches  
Length: 156.6 inches  
Width: 67.1 inches  
Height: 65.0 inches  
Ground Clearance: 6.7 inches at GVWR  
Performance Goal: 5.0 inches at GVWR

#### CHARGER<sup>2</sup>

Location: On-board w/Off-Board PCS  
Type: Conductive  
Input Voltages: 90 to 264 VAC

#### TIRES

Tire Mfg: Bridgestone  
Tire Model: Ecopia EPO2 Radial  
Tire Size: 195/80R16  
Tire Pressure F/R: 44/44 psi  
Spare Installed: Yes

#### ACCELERATION 0-50 mph

At 100% SOC: 12.8 sec  
At 50% SOC: 12.9 sec  
Max. Power: 57.3 kW  
Performance Goal: 13.5 sec at 50% SOC

#### MAXIMUM SPEED @ 50% SOC

At 1/4 Mile: 63.5 mph  
At 1 Mile: 78.8 mph  
Performance Goal: 70 mph in one mile

#### CONSTANT SPEED RANGE @ 45 mph<sup>3</sup>

Range: 110.9 miles  
Energy Used: 23.34 kWh  
Average Power: 9.55 kW  
Efficiency: 210 Wh/mile  
Specific Energy: 50.8 Wh/kg

#### CONSTANT SPEED RANGE @ 60 mph<sup>3</sup>

Range: 86.9 miles  
Energy Used: 27.47 kWh  
Average Power: 18.81 kW  
Efficiency: 316 Wh/mile  
Specific Energy: 59.6 Wh/kg

#### DRIVING CYCLE RANGE<sup>3,4</sup>

Range per SAE J1634: 94.0 miles  
Energy Used: 23.01 kWh  
Average Power: 6.88 kW  
Efficiency: 245 Wh/mile  
Specific Energy: 49.9 Wh/kg  
Performance Goal: 60 miles

#### BRAKING FROM 60 mph

Controlled Dry: 157.0 feet  
Controlled Wet: 183.2 feet  
Panic Wet: 200.1 feet  
Course Deviation: 0.0 feet

#### HANDLING

Avg Time @ 90% SOC: 59.8 sec  
Avg Time @ 50% SOC: 58.8 sec  
Avg Time @ 20% SOC: 58.8 sec  
Avg S-10 ICE Time: 59.8 sec

#### GRADEABILITY (Calculated)

Maximum Speed @ 3%: 75.4 mph  
Maximum Speed @ 6%: 63.6 mph  
Maximum Grade: 30.2%  
Time on 3% Grade: 21 min 37 sec<sup>3</sup>  
Performance Goal: 15 Min from 50% SOC

#### CHARGING EFFICIENCY

Efficiency: 432 Wh-AC/mile  
Energy Cost @ 10 ¢/kWh: 4.32 ¢/mile

#### CHARGER

Max Charger Ground Current: <0.01 mA  
Max Battery Leakage Current: 0.01 MIU  
Max DC Charge Current: 14.51 Amps  
Max AC Charge Current: 26.25 Amps  
Pwr Factor @ Max Current: 0.828  
THD(I) @ Max Current: 8.26%  
Peak Demand: 4.45 kW-AC  
Time to Recharge: 6 Hrs 47 min  
Performance Goal: 8 hours

#### TEST NOTES:

1. Design payload value; value as delivered (and tested) was 759 lbs.
2. This vehicle requires a Power Control Station (PCS), which cannot be used with a GFCI protected circuit.
3. All testing was terminated upon receipt of the Flashing SOC telltale.
4. Total range achieved until vehicle could not maintain profile was 116.9 miles.
5. Charge time will be periodically extended 2 hours after a predetermined number of charge cycles has occurred, and when certain battery temperature or voltage conditions exist.
6. On several occasions, charging was impeded due to battery temperature conditions (high dT/dt).
7. One PCS unit had to be replaced due to inconsistent charging.

[This Vehicle meets all EV America Minimum Requirements listed on back.](#)

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

All Power and Energy values are DC unless otherwise specified.

**This vehicle meets the following EV America Minimum Requirements:**

1. Vehicle has a payload of at least 400 pounds.
2. The OEM GVWR has not been increased.
3. The OEM GAWRs have not been increased.
4. Seating capacity is at least two (2) occupants.
5. A battery recycling plan has been submitted.
6. The OEM passenger space has not been intruded upon by the electrical conversion materials.
7. The vehicle has a parking mechanism or parking brake as required by 49 CFR 571.105.
8. The vehicle has a minimum range between charges of at least 50 miles when loaded with two 166-pound occupants and operated at a constant 45 mph.
9. The vehicle manufacturer has certified that this vehicle complies with the Federal Motor Vehicle Safety Standards (FMVSS) applicable on the date of manufacture.
10. The vehicle manufacturer has certified the batteries and battery enclosures comply with SAE J1766 and 49 CFR 571.301.
11. Batteries comply with the requirements of SAE J1718 and NEC 625 for charging in enclosed spaces without vent fans.
12. The vehicle manufacturer has certified that concentrations of explosive gases in the battery box do not exceed 25% of the Lower Explosive Limit (LEL) during and following normal or abnormal charging and operation of the vehicle.
13. The battery charger is capable of recharging the main propulsion batteries to a state of full charge from any state of discharge in less than 12 hours.
14. The vehicle manufacturer has certified the charger is capable of accepting input voltages of 208V and 240V single phase 60 Hertz alternating current service, with a tolerance of 10% of rated voltage. Charger input current is compatible with the requirements for Level II chargers and complies with the requirements of SAE J1772. Personnel protection systems are in accordance with UL Proposed Standards 2231-1 and 2231-2.
15. The charger has a true power factor of .95 or greater and a harmonic distortion rated at < 20% (current at rated load).
16. The charger is fully automatic, determining when "end of charge" conditions are met and transitioning into a mode that maintains the main propulsion battery at a full state of charge while not overcharging it, if continuously left on charge.
17. 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.
18. The vehicle will be accompanied by non-proprietary manuals for parts, service, operation, maintenance, interconnection wiring diagrams and schematics.
19. The vehicle has a state of charge indicator for the main propulsion batteries.
20. Propulsion power is isolated from the vehicle chassis and battery leakage is less than 0.5 MIU under static conditions.
21. Charging circuits are isolated from the vehicle chassis such that ground current from the grounded chassis any time the vehicle is connected to a charger does not exceed 5 mA in accordance with UL Proposed Standards 2231-1 and 2231-2.
22. Replacement tires are commercially available to the end user.
23. The vehicle is interlocked such that:
  - The controller does not energize to move the vehicle with the gear selector in any position other than "Park" or "Neutral"
  - The start key is removable only when the "ignition key" is in the "Off" position, with the drive selector in "Park"
  - The controller does not initially energize or excite with a pre-existing accelerator input, such that the vehicle can be moved under its own power from this condition
24. The vehicle manufacturer has certified that the vehicle complies with the FCC requirements for unintentional emitted electromagnetic radiation, as identified in 47 CFR 15, Subpart B, "Unintentional Radiators."
25. The vehicle manufacturer has certified failure of a battery or battery pack has deemed to have occurred if the actual battery capacity is not at least 80% of the nominal ampere hour capacity.
26. This vehicle is equipped with an automatic disconnect and a manual service disconnect.
27. The charging system is compatible with the Personnel Protection requirements of SAE J1772.
28. Material Safety Data Sheets (MSDS) have been supplied for all on-board batteries.
29. The level of charge below which the batteries should not be discharged and how the controller automatically limits battery discharge below this level have been identified by the manufacturer.
30. The vehicle manufacturer has verified that the method(s) of charging the propulsion batteries and the charging algorithm have been reviewed and approved by the battery manufacturer.
31. The charger is capable of meeting the requirements of Section 625 of the National Electric Code (NEC).
32. The vehicle complies with the requirements of 49 CFR 571.301 for fuel fired heaters.
33. The vehicle has an on-board Battery Energy Management System (BMS).

**This information was prepared with the support of the U. S. Department of Energy (DOE) Award No. DE-FC07-96ID 13475. However, any opinions, findings, conclusions or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of DOE.**