



Post Repair Conditioning Process

Follow the guidelines below to assure long battery life and reliable vehicle operation.

- Do not drive past the maximum range listed on the Battery M.D. service record **at any time**. This range was measured to the start of the SOC Meter “Yellow Zone.” The vehicle should never be driven beyond the “Yellow Zone”. The SOC Meter “Yellow Zone” represents the maximum usable battery capacity (range) that the battery can safely be operated without causing potential battery imbalance or damage to modules in the pack.
- For the first 4 weeks (as the vehicle systems re-learn the characteristics of the battery) follow the guidelines below:
 - Do not perform deep discharges. Vehicle should never be driven into the SOC Meter “Yellow Zone.”
 - Recharge the vehicle to full **every time** you charge.
 - Recharge the vehicle **daily** if the State-of-Charge is less than 80 %.
- After the first 4 weeks follow the guidelines below to assure long battery life and reliable vehicle operation:
 - Do not allow the vehicle to sit at a **low** State-of-Charge for long periods.
 - Recharge the vehicle to full at least **once per week**.
 - Short charging (i.e. **stopping** the charge before 100% State of Charge) will result in reduction of range and can reduce the life of the battery pack.

Following the above guidelines will increase the reliability of your vehicle, reduce the need for future rejuvenation and enable your NiMH battery to provide the longest life possible. Refer to the enclosed documents for greater detail on recommended vehicle operation.



Dear Customer,

You have either received a rejuvenation on your existing RAV4-EV battery pack or you have received a reconditioned “used” (lower mileage) battery pack. Because the pack has very different capacity and performance characteristics, it will take a while before the vehicle “learns” these new characteristics. As a result, we recommend that deep discharging (i.e. driving into the SOC Meter “Yellow Zone”) be avoided for the first month, allowing the State of Charge gauge and ECU to recalibrate to the new rejuvenated pack’s characteristics. Since the service was for either a reduced vehicle range or unbalanced voltage, we recommend immediately utilizing the following operating procedures in order to minimize the recovery time and maximize your EV’s battery life.

The attached operational recommendations were developed through extensive laboratory battery life cycle testing and in-field battery repairs on over 4,000 electric vehicles.



Post Repair Conditioning Process and General Vehicle Operational Information

- Do not drive past the maximum tested range listed on the Battery M.D. service record **at any time**. This is the maximum range that the battery pack will achieve and it will not improve over time. In fact, it will decrease over time due to natural causes. The maximum range was measured to the beginning of the SOC Meter “Yellow Zone” and this is the lowest the vehicle should be safely driven at anytime per the Toyota Owner’s Manual. The SOC Meter “Yellow Zone” represents the maximum usable battery capacity (range) that the battery can safely be operated without causing potential battery imbalance or damage to modules in the pack. Driving beyond that can cause permanent damage to the batteries.
- Range listed on the service record is the maximum range that can be realistically expected during freeway and city driving on flat ground (with the HVAC and other accessories off). If your commute utilizes higher than normal freeway speeds and/or involves hilly terrain, you will encounter reduced range due to excessive load on the battery. Driving style, hilly environments, and accessory usage can affect an electric vehicle’s range between 10% to 30%. The results of the Battery M.D. range test have been provided to give you a guideline of the maximum range based on normal driving after a pack rejuvenation or replacement. For long life and reliable operation, we recommend driving the vehicle (on a daily basis) no more than 80% of that maximum range.
- It is normal to expect lower range / capacity from the battery pack when the following items occur:
 - Outside temperatures drop below 60°F
 - Outside temperatures exceed 100°F
 - Aggressive driving habits are used
 - Use by multiple drivers
 - Hilly terrain is encountered
 - Strong headwinds are encountered
 - Tires are improperly inflated
 - The heater and/or air conditioning systems are used
 - The battery reaches > 5 years in age
 - If repeated short commutes are performed on a long term basis
 - If repeated short charging is performed on long term basis
 - If the vehicle is not fully charged after daily use or at least once a week
 - With frequent driving past the yellow is performed



- Do not attempt to perform a full driving range test (beyond the SOC Meter “Yellow Zone”) or deep discharge **at any time**.
 - Due to safety reasons – the vehicle will allow power-limiting (to enable customers to get vehicle to side of road or out of danger); however, batteries can be over-discharged once the vehicle has entered the yellow, red and power limit regions. Permanent damage to the batteries can occur as well as pack imbalance can be induced when batteries are over-discharged.
- Do not allow the vehicle to sit at a low State of Charge for long periods. If a battery is below 20% State of Charge, it should be charged immediately and not left more than 2 hours at that low State of Charge.
- The RAV4-Info data (a.k.a. Palm Pilot program that some drivers have) can provide useful and interesting data to the user; however, the driver should never use this information to over-ride the Toyota recommended operating procedures listed in the RAV4-EV’s Owners Manual. Operation of the vehicle outside the Toyota recommended operating procedures can void the warranty.
 - The vehicle should not be driven into the SOC Meter “Yellow Zone” (approximately 20% State-of-Charge). Driving the vehicle below 20% State of Charge (as displayed by the RAV4-EV info program) can be unreliable and result in permanent battery damage / pack imbalance (requiring Dealer service).
 - Accurate battery State of Charge determination for a NiMH battery pack is very difficult and requires a very complex algorithm. This algorithm is programmed into the vehicle’s ECU and takes into account many factors. However, as these batteries age the accuracy of the vehicle’s State of Charge gauge may decrease. Therefore it should not be totally relied upon when calculating the remaining available range of the vehicle. As a result, we recommend that the vehicle never be driven below 20% State of Charge in order to compensate for natural issues that can affect range and the accuracy of the vehicle’s State of Charge calculation.
 - Short charging will result in reduction of range and can reduce life of RAV4-EV battery pack. This procedure is not recommend by Toyota Owner’s Manual and the vehicle should be placed on charge and left to complete a full charge each time. Stopping the charge before full charge completion will affect range and more importantly, the overall life and balance of the pack.
- Preventing deep discharge will increase the reliability of your vehicle, reduce the need for future service and enable your NiMH battery to provide the longest life possible.

Battery M.D., Inc. Vehicle Service Record

Vehicle Information

VIN: JT3GS10V120002535 Key#: 100
 Make/Model: Toyota RAV 4 EV Year: 2002
 Date In: 4/19/11 Date Out: _____
 ODO In: 68,376 ODO Out: _____

Demonstrated Maximum Range: <u>72</u> miles	80% Recommended Range: <u>57.6</u> miles
Customer Information	
Range May Increase. Battery Computer is Still Learning Range.	

Name / Company: Thomas Gonda
 Address: 1850 Arrohead Drive, Oakland, CA 94611
 Phone #1: 510-495-4826 Phone #2: 510-495-4826
 Notes: Contact: Rich Russo - 530-753-3352 - Hanlees Toyota

Problem Description

Customer Request Battery Pack Replacement.

Incoming Inspection Notes:

Dirty Exterior & Interior. Damaged/Dented Tailgate. LIC: 4XTP359
 Dent Passenger Side Fnt & Rear Doors. Scuffed Front Bumper.
 Dent Driver Side Rear Door. Scuffed Rear Bumpers.

Warning Lights / Gauges:

None

Intermittent Condition?

Yes No

Approx. Air Temp (degree F):

0-30: 30-70: 70-100:

Diagnostic Codes:

C2809, C2831, C2852, C2853,
 C2855, C2856, C2857, C2897,
 C2895, C2934, C2945, C2953, C2961

Quits on the road? Yes___ No X, If Yes, did it restart? Yes___ No___

Labor Summary

Date	Technician	Description
4/19/2011	C.C.	Vehicle arrived at Battery MD Inc.
4/25/2011	V.P.	Vehicle Check-In.
		Check Codes. Clear Codes.
		Remove Battery Pack # 3000131.
		Install Battery Pack # 3000109.
4/26/2011	V.P.	Charge Vehicle.
		Perform SOC Calibration Test Drive of: 71 mi.
		Mileage Before Test Drive: 68,376 mi.
		Mileage After Test Drive: 68,447 mi.
		Perform Toyota SOC Calibration Procedure.
4/27/2011	C.C.	Check Codes. Clear Codes.
		Charge Vehicle.
4/28/2011	V.P.	Charge Vehicle.

Battery M.D., Inc. Vehicle Service Record

Vehicle Information

VIN:

JT3GS10V120002535

Key#:

100

Labor Summary (cont.)

Date	Technician	Description
4/28/2011	V.P.	Perform Full Range Test Drive of: 72 mi.
		Mileage Before Test Drive: 68,447 mi.
		Mileage After Test Drive: 68,519 mi.
		<i>Test Drive Was Completed As Soon As the SOC Meter Reached the Yellow Zone (20% SOC), and Low Fuel Light is On.</i>
		Check Codes. No Codes.
		Charge Vehicle.
4/29/2011	V.P.	Check Codes. No Codes.
		Charge Vehicle.

Parts/Materials Summary

Source	Description	Qty	P/N
BMD	Used Low Mileage Reconditioned Battery Pack	1	N/A

Vehicle Diagnostic Report

2002 Rav4 EV EV Battery

5/3/2011 11:51:16 AM

AFTER

Data List
Battery(1 of 2)

/Frame : 00:54:383/24

68521-MIKK6E

Battery Voltage	1.9	V
Battery Current	0.0	A
Charge %	88.4	%
Battery Temperature1	67.60	F
Battery Temperature2	66.00	F
Battery Temperature3	66.00	F
Battery Temperature	70.21	F
Module Voltage1	13.2	V
Module Voltage2	13.2	V
Module Voltage3	13.2	V
Module Voltage4	13.2	V
Module Voltage5	13.2	V
Module Voltage6	13.2	V
Module Voltage7	13.2	V
Module Voltage8	13.2	V
Module Voltage9	13.2	V
Module Voltage10	13.2	V
Module Voltage11	13.2	V
Module Voltage12	13.2	V
Module Voltage13	13.2	V
Module Voltage14	13.2	V
Module Voltage15	13.2	V
Module Voltage16	13.2	V
Module Voltage17	13.2	V
Module Voltage18	13.2	V
Module Voltage19	13.2	V
Module Voltage20	13.2	V
Module Voltage21	13.2	V
Module Voltage22	13.2	V
Module Voltage23	13.2	V
Module Voltage24	13.2	V
Charger Voltage	13.2	V
Maximum Voltage	13.2	V
Charge State	OFF	
Main Relay	OFF	
Chk Detect	OFF	
Ch SW	ON	
Rectifier	ON	
Charge Conn	OFF	
Charge	OFF	
CU Start	OFF	
Int Cool Fan 1	OFF	
Int Cool Fan 2	OFF	
Charger Conn Fan	OFF	
Inhibit	OFF	
DC Inhibit	OFF	
Int Resist 1	8.3	mOhm
Int Resist 2	8.4	mOhm
Int Resist 3	8.4	mOhm
Int Resist 4	8.4	mOhm
Int Resist 5	8.5	mOhm
Int Resist 6	7.9	mOhm
Int Resist 7	7.6	mOhm
Int Resist 8	7.7	mOhm
Int Resist 9	7.7	mOhm
Int Resist 10	7.9	mOhm
Int Resist 11	7.8	mOhm
Int Resist 12	7.7	mOhm
Int Resist 13	7.6	mOhm
Int Resist 14	8.2	mOhm
Int Resist 15	8.2	mOhm

Data List
Battery(2 of 2)

Resist 16	8.7	mOhm
Resist 17	8.2	mOhm
Resist 18	8.4	mOhm
Resist 19	8.7	mOhm
Resist 20	8.3	mOhm
Resist 21	8.3	mOhm
Resist 22	7.9	mOhm
Resist 23	9.9	mOhm
Resist 24	7.9	mOhm
Number of Trouble Codes	0	