HEVAmerica

U.S. Department of Energy Advanced Vehicle Testing Activity

2006 Toyota Highlander Hybrid EV

VEHICLE SPECIFICATIONS

VEHICLE FEATURES

Base Vehicle: 2006 Highlander
VIN: JTEDW21A860005681
Seatbelt Positions: Seven
Standard Features:

- Air Conditioning
- Power Locks
- Power Steering
- Power Brakes
- Power Windows
- Cruise Control
- Power Seats
- Front/Rear Disc Brakes
- Tilt Wheel
- Four Wheel Drive
- Regenerative Braking
- Anti-Lock Brakes
- Full Spare Tire
- Air Bags
- 5 Speed Automatic
- AM/FM Stereo with CD player
- State of Charge Meter[1]

BATTERY

Manufacturer: Panasonic EV
Type: Nickel-Metal Hydrid
Number of Modules: 30
Pack(s) Location: Under Rear Seats
Nominal Module Voltage: 9.6VDC
Nominal System Voltage: 288V
Nominal Pack Capacity: 6.5 Ah
Front Electric Motor: 123 kW
Rear Electric Motor: 50 kW

WEIGHTS

Design Curb Weight: 4245 lbs
Delivered Curb Weight: 4118 lbs
GVWR: 5675 lbs
GAWR F/R: 2865/3130 lbs
Distribution F/R: 59/41 %
Payload: 1557 lbs
Performance Goal: 400 lbs

DIMENSIONS

Wheelbase: 106.7 in
Track F/R: 61.9/61.1 in
Length: 185.3 in
Width: 71.5 in
Height: 68.6 in
Ground Clearance: 5.9 in
Performance Goal: 5.0 in

TIRES

Tire Mfg: Goodyear
Tire Model: Integrity
Tire Size: P225/65R17
Tire Pressure F/R: 32/32
Spare Installed: Yes

ENGINE

Model: 3MZ-FE
Output: 268 hp @ 5600 rpm
Configuration: V6
Displacement: 3.3 L
Fuel Tank Capacity: 17.2 gal
Fuel Type: Unleaded Gasoline

TEST NOTES:

1. Energy transfer display
2. Total battery charge/discharge over SAE J1634 drive cycle
3. Value calculated based on fuel economy and fuel tank size
4. Air Conditioning on maximum with full blower

This vehicle meets all HEV America Minimum Requirements listed on back of this sheet
Values in red indicate the Performance Goal was not met. All Power and Energy Values are DC unless otherwise specified.

PERFORMANCE STATISTICS

Acceleration 0-60 mph

Acceleration 0-60 mph
Measured: 8.75 seconds
Performance Goal: 13.5 seconds

Maximum Speed

At ¼ Mile: 88.9 mph
In 1 Mile: 117.3 mph
Performance Goal: 70 mph in one mile

Driving Cycle Range w/o Accessories

Amp-Hours Out: 10.66 Ahrs[2]
Amp-Hours In: 11.61 Ahrs[2]
Cycle Fuel Economy: 32.8 mpg
Driving Range: 564.16 mi[3]

Driving Cycle Range w/Accessories[4]

Amp-Hours Out: 10.47 Ahrs[2]
Amp-Hours In: 11.58 Ahrs[2]
Cycle Fuel Economy: 24.6 mpg
Driving Range: 423.12 mi[3]

Braking From 60 mph

Controlled Dry: 133.21 feet

Gradeability (Calculated)

Maximum Speed @ 3%: 112 mph
Maximum Speed @ 6%: 106
Maximum Grade: 43%

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This vehicle meets the following HEVAmerica minimum requirements:

(1) Vehicles shall comply with Federal Motor Vehicle Safety Standards applicable on the date of manufacture and such compliance shall be certified by the manufacturer in accordance with 49 CFR 567. Suppliers shall provide a completed copy of Appendix A and Appendix B with their proposal, providing vehicle specifications and the method of compliance with each required section of 49 CFR 571. If certification includes exemption, the exemption number issued by the National Highway Transportation Safety Administration (NHTSA), the date of it's publication in the Federal Register and the page number(s) of the Federal Register acknowledging issuance of the exemption shall be provided along with Appendix B. Exemptions for any reason other than non-applicability shall not be allowed.

(2) Suppliers shall supply Material Safety Data Sheets (MSDS) for all unique hazardous materials the vehicle is equipped with, including RESS batteries or capacitors, and auxiliary batteries.

(3) Suppliers shall provide recycling plans for batteries and other vehicle hazardous materials including how the plan has been implemented.

(4) All vehicles shall comply with the FCC requirements for unintentional emitted electromagnetic radiation, as identified in 47 CFR 15, Subpart B, "Unintentional Radiators."

(5) Vehicles shall have a minimum payload of at least 400 pounds.

(6) For conversions, OEM GVWR shall not be increased. For conversion vehicles, Suppliers shall specify the OEMs gross vehicle weight rating (GVWR).

(7) For conversions, OEM Gross Vehicle Axle Weight Ratings (GAWR) shall not be increased. Suppliers shall provide axle weights for the vehicle as delivered, and at full rated payload.

(8) Tires shall be subject to the following requirements:
- Tires provided with the vehicle shall be the standard tire offered by the HEV Supplier for the vehicle being proposed.
- Tires shall correspond to the requirements of the placard installed in accordance with 49 CFR 571.109, 110, 119 and 120, as applicable.
- Suppliers shall specify manufacturer, model and size of the standard tire.
- Tires sizes and inflation pressures shall be in accordance with the requirements of the placard.
- At no time shall the tire's inflation pressure exceed the maximum pressure imprinted upon that tire's sidewall.
- The tire shall be operable across the entire operation/load range of that vehicle.
- Replacement tires shall be commercially available to the end user in sufficient quantities to support the purchaser's needs.
- Tires provided as original equipment by the HEV manufacturer shall not have warranty restrictions in excess of those of the tire's manufacturer, unless the Supplier is the sole warrantor for the tires.
- If the vehicle may be equipped with more than one standard tire, this information shall be provided for each type/manufacturer of each standard tire.

(9) Seating capacity shall be a minimum of 1 driver and 1 passenger. Suppliers shall specify seating capacity (available seat belt positions) for their vehicle. For conversion vehicles, if the vehicle's seating capacity is changed from that specified by the OEM on their FMVSS placard, the seat(s) being added or abandoned shall be modified as required by 49 CFR 571.207, et al, and a new FMVSS placard installed as required by 49 CFR 567, 568 or 571, as applicable.

(10) For conversion vehicles, the OEM passenger space shall not be intruded upon by the Rechargeable Energy Storage System (RESS) or other conversion materials.

(11) The vehicle may utilize a single speed, multi-speed automatic, manual transmission, or a Continuously Variable Transmission (CVT), and shall have a parking mechanism.

(12) The controller/inverter shall limit the minimum RESS battery discharge voltage to prevent degradation of battery life, and should limit the maximum regeneration voltage to prevent external gassing of the batteries.

(13) Vehicles shall comply with the requirements of 49 CFR 571.105.S5.2.1, or alternatively, 49 CFR 571.105.S5.2.2 for parking mechanisms.

(14) If different, customer available and battery available DOD ratings shall both be provided.

(15) Batteries shall comply with the requirements of SAE J1718.
Vehicles shall not auto-start the engine to charge the batteries while the vehicle is parked and the key switch is in the OFF position.
For vehicles capable of off-vehicle charging (OVC), RESS batteries shall meet the requirements of NEC 625-29© or (d) for charging in enclosed spaces without a vent fan. The vehicle shall be labeled as not requiring ventilation for charging (or have the appropriate classification label from a UL-recognized Testing Laboratory).

(16) For vehicles with RESS system voltages of 48 volts and higher, batteries or capacitors and their enclosures shall be designed and constructed in a manner that complies with 49 CFR571.305. For vehicles with RESS system voltages below 48VDC, batteries or capacitors, and their enclosures, shall be designed and constructed in accordance with the requirements of SAE J1766. Further, irrespective of RESS system voltage, batteries or capacitors, and electrolyte will not intrude into the passenger compartment during or following FMVSS frontal barrier, rear barrier and side impact collisions, and rollover requirements of 49 CFR 571.301. Suppliers shall provide verification of conformance to this requirement.

(17) Concentrations of explosive gases in the battery box shall not be allowed to exceed 25% of the LEL (Lower Explosive Limit). Suppliers shall describe how battery boxes will be vented, to allow any battery gases to escape safely to atmosphere during and following normal or abnormal charging and operation of the vehicle. Battery gases shall not be allowed to enter the occupant compartment.
Batteries shall comply with the requirements of SAE J1718. and at a minimum shall meet the requirements of NEC 625-29© or (d) for charging in enclosed spaces without a vent fan.

(18) If a Supplier provides a vehicle with parallel battery packs, the Supplier shall provide detailed information on the equipment and charging algorithms required to prevent the parallel strings from becoming unbalanced.

(19) Flywheels and their enclosures shall be designed and constructed such that there is complete containment of the flywheel energy storage system during all modes of operation. Additionally, flywheels and their enclosures shall be designed and constructed such that there is complete containment of the flywheel energy storage system during or following frontal barrier, rear barrier and side impact collisions, and roll-over requirements of 49 CFR 571.301. Suppliers shall provide verification of conformance to this requirement.

(20) For vehicles using fuels other than gasoline, manufacturers shall indicate compliance with appropriate and applicable standards from SAE, NFPA, etc. [e.g., for vehicles using Compressed Natural Gas as fuel, manufacturers should indicate compliance with NFPA 52, "Compressed Natural Gas (CNG) Vehicular Fuel Systems Code," as well as 49 CFR 571.303 and 304.].

(21) Rechargeable Energy Storage Systems (RESS) shall be battery, capacitor, or electromechanical flywheel technology-based as defined in SAE J1711.

(22) Vehicles shall not contain exposed conductors, terminals, contact blocks or devices of any type that create the potential for personnel to be exposed to 60 volts or greater (the distinction between low-voltage and high voltage, as specified in SAE J1127, J1128, et al.). Access to any high voltage components shall require the removal of at least one bolt, screw, or latch. Devices considered to be high voltage components shall be clearly marked as HIGH VOLTAGE. These markings should be installed at any point the voltage can be accessed by the end user. Additionally, cable and wire marking shall consist of orange wire and/or orange sleeving as identified in SAE-J1127.

(23) For propulsion power systems with voltages greater than or equal to 48VDC, the system shall be isolated from the vehicle chassis such that leakage current does not exceed 0.5 MIU. Charging circuits for RESS battery systems with voltages greater than or equal to 48VDC shall be isolated from the vehicle chassis such that ground current from the grounded chassis does not exceed 5 mA at any time the vehicle is connected to an off-board power supply.

(24) The automatic disconnect for the RESS batteries shall be capable of interrupting maximum rated controller/inverter current. The Supplier shall describe the automatic disconnect provided for the main propulsion batteries.

(25) The vehicle shall be prevented from being driven with the key turned on and the drive selector in the drive or reverse position while the vehicle's charge cord is attached. Additionally, the following interlocks shall be present:
- The controller shall not initially energize to move the vehicle with the gear selector in any position other than "PARK" or "NEUTRAL;"
- The start key shall be removable only when the "ignition switch" is in the "OFF" position, with the drive selector in "PARK;"
- With a pre-existing accelerator input, the controller shall not energize or excite such that the vehicle can move under its own power from this condition.

(26) If the vehicle is capable of off-board recharging of the RESS, the charger shall be capable of recharging the RESS to a state of full charge from any possible state of discharge in less than 12 hours, at temperatures noted in Section 5.5, as applicable.
The charger shall be 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.

(27) If the vehicle is capable of off-board recharging of the RESS, the chargers shall use 120V or 208/240V single-phase 60-Hertz alternating current service, with an input voltage tolerance of ±10% of rated voltage. Input current for chargers operating at 208V and 240V shall be compatible with 40-ampere circuit breakers.
Personnel protection systems shall be in accordance with the requirements of UL Standard 2202 and shall be determined based upon RESS system voltages. All personnel protection systems shall meet the requirements specified in the applicable sections of UL2231-1 and 2231-2.

(28) If the vehicle is capable of off-board recharging of the RESS using a 208/240V charger, chargers shall have a true power factor of .95 or greater and a harmonic distortion rated at ≤ 20% (current at rated load).

(29) Regardless of the charger type used, the charger shall conform to the requirements of UL Proposed Standard 2202.

(30) The installation of options shall not relieve Suppliers of meeting other "shall" requirements.

(31) Vehicles shall be accompanied by non-proprietary manuals for parts, service, operation and maintenance, interconnection wiring diagrams and schematics.

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