

ETA-TP014

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Electric Vehicle Range Testing Using Level III Charging

Prepared by

Electric Transportation Applications

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1.0 Objective

The objective of this procedure is to identify proper methods for the control of range tests completed when using Rapid (Fast) Charging methods. These methods are not meant to supersede those of the testing facility, those specifically addressed by SAE Test Standards, nor of any regulatory agency who may have or exercise control over the covered activities.

2.0 Purpose

The purpose of this procedure is to identify acceptable methods for the implementation of a range test, when the vehicle is being recharged using Rapid Charging methodologies. While other procedures exist for constant speed range testing (e.g., ETA-TP004 and SAE J227a) Rapid Charging significantly alters the deployment capabilities for electric vehicles. As such, different test methods are required to adequately assess the performance and range characteristics this protocol specifically addresses the unique characteristics associated with Rapid Charging. This procedure provides a method for the uniform testing of vehicles using Rapid Charging and provides direction for the collection and retention of test data as specified in the EV America Technical Requirements.

3.0 Documentation

Documentation addressed by this procedure shall be consistent, easy to understand, easy to read and readily reproducible. This documentation shall contain enough information to "stand alone"; that is, be self-contained to the extent that all individuals qualified to review it could be reasonably expected to reach a common conclusion, without the need to review additional documentation. Review and approval of test documentation shall be in accordance with ETA-AC004, "Review of Test Results." Storage and retention of records during and following testing activities shall be completed as described in Procedure ETA-AC001, "Control, Close-out and Storage of Documentation."

4.0 Initial Conditions and Prerequisites

Prior to conduct of any portion of the testing, the following initial conditions and prerequisites shall be met. Satisfactory completion of these items shall be verified as complete and recorded on the applicable Test Data Sheet.

- 4.1 Personnel conducting testing under this procedure shall be familiar with the requirements of this procedure, and when applicable the appropriate SAE Test Instructions, Administrative Control Procedures, and be certified by the Program Manager, Test Manager or specific Test Engineer prior to commencing any testing activities.
- 4.2 Documentation
 - 4.2.1 All documentation required to complete the testing shall be completed, approved and issued (past it's effective date) prior to commencing the testing it addresses.
 - 4.2.2 Verify that Procedures ETA-AC006, "Vehicle Verification," and ETA-TP011, "Receipt Inspection," have been completed.
 - 4.2.3 The test date, and starting and ending times, shall be recorded.
 - 4.2.4 The starting and ending vehicle odometer readings shall be recorded.
 - 4.2.5 Any deviation from the test procedure and the reason for the deviation, shall be recorded in accordance with ETA-AC002.
- 4.3 Road Testing
 - 4.3.1 Road tests shall be performed on a road or test track which is level to within 1%.
 - 4.3.2 Battery temperatures at the beginning of the test shall be between 60°F and 120°F (16°C to 49°C).
 - 4.3.3 Ambient temperature during road testing shall be within the range of 40°F to 100°F (5°C to 38°C).
 - 4.3.4 The recorded average wind speed at the test site during the test shall not exceed 10 mph (16 km/h).
 - 4.3.5 Environmental conditions during the testing shall be recorded and include, at a minimum, the following:
 - 4.3.5.1 Range of ambient temperature during the test;
 - 4.3.5.2 Range of wind velocity during the test;
 - 4.3.5.3 Range of wind direction during the test.
 - 4.3.6 A description of the test route, road surface type and condition (SAE J688), and lengths and grades of test route, shall be recorded.
- 4.4 Vehicle Configuration

- 4.4.1 Vehicle shall be tested in its normal configuration with normal appendages (mirrors, bumpers, hubcaps, etc.). Certain items (hub caps, etc.) may be removed where necessary for safety on the dynamometer.
 - 4.4.2 Vehicles shall be tested at curb weight plus 332 pounds. Consideration should be given to how adding instrumentation will affect the test weight and balance of the vehicle.
 - 4.4.3 Tires provided with the vehicle shall be the standard tire offered by the Electric Vehicle manufacturer, and shall be inflated to the manufacturer's (placard) recommended cold inflation pressures. This pressure shall not exceed the maximum allowable pressure imprinted upon the tire's sidewall.
 - 4.4.4 Normal manufacturer's recommended lubricants shall be employed.
 - 4.4.5 Vehicle accessories shall not be used during testing activities.
 - 4.4.6 Vehicle windows shall be closed during the duration of the testing.
- 4.5 Data Acquisition and Reduction
- 4.5.1 The following data shall be collected during conduct of the various tests specified by this procedure. Overall error in recording or indicating instruments shall not exceed $\pm 2\%$ of the maximum value of the variable being measured. Periodic calibration should be performed and documented to ensure compliance with this requirement.
 - 4.5.1.1 Battery voltage versus time;
 - 4.5.1.2 Battery current versus time;
 - 4.5.1.3 Vehicle speed versus time;
 - 4.5.1.4 Distance versus time;
 - 4.5.1.5 Battery temperature versus time;
 - 4.5.1.6 Battery watts versus time;
 - 4.5.2 All instrumentation used in the test shall be listed on Appendix E, attached to the test data sheets/results, and shall include the following information:
 - 4.5.2.1 Manufacturer
 - 4.5.2.2 Model Number
 - 4.5.2.3 Serial Number
 - 4.5.2.4 Last Calibration date
 - 4.5.2.5 Next Calibration date
 - 4.5.3 The speed-time measuring device and other necessary equipment shall be installed so that they do not hinder vehicle operation or

alter the operating characteristics of the vehicle. Mounting will nominally be at the rear of the vehicle.

- 4.5.4 During data reduction, the actual distance traveled and the corresponding DC Kilowatt-hour consumption shall be determined from the test data.

4.6 Charging Requirements

- 4.6.1 During range testing, unless specifically required by the manufacturer in the Owner's Manual, only Level III Charging shall be used.
- 4.6.2 If Level II charging is required, it will be conducted on the schedule mandated by the the Owner's Manual.
- 4.6.3 If Level II charging is required, it shall be performed at the completion of the day's drive schedule immediately prior to the scheduled requirement.
- 4.6.4 Should a combination of Level II and Level III charging be required, the sequences shall be as mandated by the Owner's Manual.
- 4.6.5 Vehicles shall not be left attached to the Level III charger if not actively charging. [When a Level III charge is complete, it shall be removed from the charger, wether it is to be driven or not.]
- 4.6.6 All range testing shall be started with the batteries charged to the normal shut-off point of the Level III charger.
- 4.6.7 All range testing shall be started with the batteries charged to the normal shut-off point of the Level III charger.
- 4.6.8 If Level II charging is required due to the manufacturer's mandated charging sequence, the vehicle shall be run off at 45 mph to the mandated charging point, and then recharged using the Level III charger before starting any test.
- 4.6.10 When conducting the Maximum Range Achievable in 12 hours Test, the last charge prior to starting testing shall be using a Level II charge. All charges during the testing shall be Level III charges, unless specifically required by the owners manual to be otherwise, and implemented as follows:
 - 4.6.10.1 If a Level II charge must be completed every X cycles, then a Level II charge will be completed on the X charge cycle, irrespective of whether it impacts the day's drive schedule requirements. If an interruption to the daily cycle occurs as a result, the interruption shall not change the daily mileage requirement.

- 4.6.10.1 If a Level II charge must be completed within every X cycles, then a Level II charge will be completed after completion of a day's drive schedule but prior to the day in which the X charge cycle would occur.

Full charge conditions for the main propulsion batteries shall be established using the manufacturer's recommended charging procedure and equipment in accordance with ETA-TP013, "Rapid Battery Charging."

5.0 Testing Activities Requirements

This test is designed to determine the maximum range achievable during a twelve-hour period when operated over a consecutive three-day period. To achieve this, each day's schedule will track time on charge and time driving, miles driven in a consecutive 12-hour period, kWh-AC consumed during charging in a consecutive 12-hour period, and kWh-DC consumer by the vehicle during driving. Each day's test schedule is different than the other two days schedules, and is comprised of individual segments, with each segment's distance being driven at the speed indicated in the applicable Appendix. The total mileage driven over the three-day period shall be averaged to determine the average miles per day.

NOTE

All steps shall be completed in the order written. Deviations from any step or requirement shall have the approval of the Program Manager or Test Manager in accordance with Procedure ETA-AC002, "Control of Test Conduct."

NOTE

The time between the end of a drive segment and the start of a charge cycle, or the end of a charge cycle and the start of a drive segment, shall not exceed five minutes.

NOTE

Prior to Commencing this test, it is necessary to determine the miles to be driven during each segment of each day. To accomplish this, the 45-mph and 60-mph Constant Speed Range Tests per ETA-TP004 must have been completed. Obtain the final approved data from those two tests before commencing this test.

5.1 Range at Day 1

The purpose of this section is to determine the maximum range the vehicle can achieve during a twelve (12) hour period while periodically recharging the battery using Rapid Charging and operated at the speeds detailed in Appendix A. Vehicles shall have a minimum range in any eight-hour period of 100 miles, with a range of at least 35 miles between any two charging segments when loaded with two 166-pound occupants (or equivalent) and operated at the speed(s) required for the segment(s) being driven.

This testing shall be completed subject to the initial conditions and prerequisites stated in Section 4 of this procedure.

5.1.1 Instrument the vehicle to obtain, at a minimum, the data identified in Section 4.5. Calibrate the fifth wheel, as necessary.

- 5.1.2 Using the range achieved during the performance of the 45- and 60-mph constant speed range tests in ETA-TP004, and the required percentage of range identified in Appendix A, compute the mileage to be driven in each segment and record on Appendix A.
- 5.1.3 Verify the traction battery is at fully charged per ETA-TP013.
- 5.1.4 Record time and the vehicle's odometer reading on Appendix A.
- 5.1.5 Adjust the vehicle's cold tire pressures to match the manufacturer's placard value, or the maximum cold inflation pressure imprinted upon the tire's sidewall, whichever is less.
- 5.1.6 Verify the Data Acquisition system is operating and recording data.
- 5.1.7 From a standing start, accelerate the vehicle under its own power to a speed determined by the appropriate drive schedule as identified on Appendix A.
- 5.1.8 Maintain this drive segment speed without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix A. The mileage achieved during this segment shall also be recorded.
- 5.1.9 Return the vehicle to the Charging Station, and recharge the vehicle according to ETA-TP013. Record the initial SOC reading, time the charge commenced, and sequential Rapid Charge number since last equalizing/leveling charge.
- 5.1.10 At the completion of the charging cycle, record the charging data, including energy returned, SOC meter reading and battery temperature on Appendix A.
- 5.1.11 Using Appendix A, commence the second segment drive schedule. Continue this drive schedule without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix A. The mileage achieved shall also be recorded.
- 5.1.12 Return the vehicle to the Charging Station, and recharge the vehicle according to ETA-TP013. Record the initial SOC reading, time the charge commenced, and sequential Rapid Charge number since last equalizing/leveling charge.
- 5.1.13 At the completion of the charging cycle, record the charging data, including energy returned, SOC meter reading and battery temperature on Appendix A.
- 5.1.14 Using Appendix A, commence the next sequential drive segment schedule. Continue this drive schedule without interruption until the segment range has been achieved. Record the final speed, odometer

reading, SOC and time on Appendix A. The mileage achieved shall also be recorded.

- 5.1.15 Repeat Steps 5.1.11 through 5.1.14 until all required drive schedules for Day 1 have been completed.
- 5.1.16 Determine the total energy returned and total miles driven for the day, and record on Appendix A.
- 5.1.17 Record the following on Appendix A:
 - 5.1.17.1 Average Speed
 - 5.1.17.2 Average Distance Required
 - 5.1.17.3 Average Distance Traveled
 - 5.1.17.4 Average kWh per charge

5.2 Range at Day 2

The purpose of this section is to determine the maximum range the vehicle can achieve during a twelve (12) hour period while periodically recharging the battery using Rapid Charging and operated at the speeds detailed in Appendix B. Vehicles shall have a minimum range in any eight-hour period of 100 miles, with a range of at least 35 miles between any two charging segments when loaded with two 166-pound occupants (or equivalent) and operated at the speed(s) required for the segment(s) being driven.

This testing shall be completed subject to the initial conditions and prerequisites stated in Section 4 of this procedure.

- 5.2.1 Instrument the vehicle to obtain, at a minimum, the data identified in Section 4.5. Calibrate the fifth wheel, as necessary.
- 5.2.2 Using the range achieved during the performance of the 45- and 60-mph constant speed range tests in ETA-TP004, and the required percentage of range identified in Appendix B, compute the mileage to be driven in each segment and record on Appendix B
- 5.2.3 Verify the traction battery is at fully charged per ETA-TP013.
- 5.2.4 Record time and the vehicle's odometer reading on Appendix B.
- 5.2.5 Adjust the vehicle's cold tire pressures to match the manufacturer's placard value, or the maximum cold inflation pressure imprinted upon the tire's sidewall, whichever is less.
- 5.2.5 Verify the Data Acquisition system is operating and recording data.
- 5.2.7 From a standing start, accelerate the vehicle under its own power to a speed determined by the appropriate drive schedule as identified on Appendix B.
- 5.2.8 Maintain this drive segment speed without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix B. The mileage achieved during this segment shall also be recorded.
- 5.2.9 Return the vehicle to the Charging Station, and recharge the vehicle according to ETA-TP013. Record the initial SOC reading, time the charge commenced, and sequential Rapid Charge number since last equalizing/leveling charge.
- 5.2.10 At the completion of the charging cycle, record the charging data, including energy returned, SOC meter reading and battery temperature on Appendix B.

- 5.2.11 Using Appendix B, commence the second segment drive schedule. Continue this drive schedule without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix B. The mileage achieved shall also be recorded.
- 5.2.12 Return the vehicle to the Charging Station, and recharge the vehicle according to ETA-TP013. Record the initial SOC reading, time the charge commenced, and sequential Rapid Charge number since last equalizing/leveling charge.
- 5.2.13 At the completion of the charging cycle, record the charging data, including energy returned, SOC meter reading and battery temperature on Appendix B.
- 5.2.14 Using Appendix B, commence the next sequential drive segment schedule. Continue this drive schedule without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix B. The mileage achieved shall also be recorded.
- 5.2.15 Repeat Steps 5.2.11 through 5.2.14 until all required drive schedules for Day 1 have been completed.
- 5.2.16 Determine the total energy returned and total miles driven, and record on Appendix B.
- 5.2.17 Record the following on Appendix B:
 - 5.2.17.1 Average Speed
 - 5.2.17.2 Average Distance Required
 - 5.2.17.3 Average Distance Traveled
 - 5.2.17.4 Average kWh per charge

5.3 Range at Day 3

The purpose of this section is to determine the maximum range the vehicle can achieve during a twelve (12) hour period while periodically recharging the battery using Rapid Charging and operated at the speeds detailed in Appendix C. Vehicles shall have a minimum range in any eight-hour period of 100 miles, with a range of at least 35 miles between any two charging segments when loaded with two 166-pound occupants (or equivalent) and operated at the speed(s) required for the segment(s) being driven.

This testing shall be completed subject to the initial conditions and prerequisites stated in Section 4 of this procedure.

- 5.3.1 Instrument the vehicle to obtain, at a minimum, the data identified in Section 4.5. Calibrate the fifth wheel, as necessary.
- 5.3.2 Using the range achieved during the performance of the 45- and 60-mph constant speed range tests in ETA-TP004, and the required percentage of range identified in Appendix B, compute the mileage to be driven in each segment and record on Appendix B
- 5.3.3 Verify the traction battery is at fully charged per ETA-TP013.
- 5.3.4 Record time and the vehicle's odometer reading on Appendix C.
- 5.3.5 Adjust the vehicle's cold tire pressures to match the manufacturer's placard value, or the maximum cold inflation pressure imprinted upon the tire's sidewall, whichever is less.
- 5.3.6 Verify the Data Acquisition system is operating and recording data.
- 5.3.7 From a standing start, accelerate the vehicle under its own power to a speed determined by the appropriate drive schedule as identified on Appendix C.
- 5.3.8 Maintain this drive segment speed without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix C. The mileage achieved during this segment shall also be recorded.
- 5.3.9 Return the vehicle to the Charging Station, and recharge the vehicle according to ETA-TP013. Record the initial SOC reading, time the charge commenced, and sequential Rapid Charge number since last equalizing/leveling charge.
- 5.3.10 At the completion of the charging cycle, record the charging data, including energy returned, SOC meter reading and battery temperature on Appendix C.

- 5.3.11 Using Appendix C, commence the second segment drive schedule. Continue this drive schedule without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix C. The mileage achieved shall also be recorded.
- 5.3.12 Return the vehicle to the Charging Station, and recharge the vehicle according to ETA-TP013. Record the initial SOC reading, time the charge commenced, and sequential Rapid Charge number since last equalizing/leveling charge.
- 5.3.13 At the completion of the charging cycle, record the charging data, including energy returned, SOC meter reading and battery temperature on Appendix C.
- 5.3.14 Using Appendix C, commence the next sequential drive segment schedule. Continue this drive schedule without interruption until the segment range has been achieved. Record the final speed, odometer reading, SOC and time on Appendix C. The mileage achieved shall also be recorded.
- 5.3.15 Repeat Steps 5.2.11 through 5.2.14 until all required drive schedules for Day 3 have been completed.
- 5.3.16 Determine the total energy returned and total miles driven, and record on Appendix C.
- 5.3.17 Record the following on Appendix C:
 - 5.3.17.1 Average Speed
 - 5.3.17.2 Average Distance Required
 - 5.3.17.3 Average Distance Traveled
 - 5.3.17.4 Average kWh per charge

5.4 Calibration of the Vehicle Speedometer

This activity is normally completed using ETA-TP004. If, for some reason, that test is not being completed, calibration should be completed using this procedure. It may also be completed concurrent with conducting ETA-TP011, "Receipt Inspection." It may also be implemented any time the speedometer is suspected of misoperation. If the calibration is being completed independent of ETA-TP004, do not complete steps 5.4.1, 5.4.2 or 5.4.3.

- 5.4.1 When accelerating the vehicle, record the vehicle speedometer reading compared to the installed Data Acquisition System (DAS) speed reading, in 10 mph increments, up to and including the final speed achieved. [To promote safety, this may be done verbally by speaking to a tape recorder, and then later transcribed into Appendix D.]
- 5.4.2 The error between the speedometer and the DAS readout shall be calculated and the results posted in the vehicle for the driver to use.
- 5.4.3 If the driver notices a difference between the indicated value and the calculated correction factor, this test should be run again.
- 5.4.4 If the vehicle is being operated for the sole purpose of calibrating the speedometer, calibration should be as follows:
 - 5.4.4.1 Ensure the vehicle is instrumented with a DAS.
 - 5.4.4.2 With the vehicle stopped, record the speedometer reading.
 - 5.4.4.3 Accelerate the vehicle to 5 mph; record the speedometer reading and the DAS heads-up display speed readout.
 - 5.4.4.4 Increase vehicle speed in 5 mph increments, recording the speedometer and heads-up display speed read-out at each speed. Continue this until the vehicle has achieved 60 mph.
 - 5.4.4.5 Increase the vehicle speed to 80 mph (or maximum achievable speed, whichever is less) and record the speedometer reading and the DAS heads-up display speed read-out.
 - 5.4.4.5 Increase the vehicle speed to 80 mph (or maximum achievable speed, whichever is less) and record the speedometer reading and the DAS heads-up display speed read-out.
 - 5.4.4.6 Develop a calibration reference table, Appendix D, for the speedometer.
 - 5.4.4.7 Mount the calibration reference table in the subject vehicle adjacent to the speedometer.

6.0 GLOSSARY

- 6.1 Curb Weight - The total weight of the vehicle including batteries, lubricants, and other expendable supplies but excluding the driver, passengers, and other payloads.
- 6.2 Effective Date - The date, after which a procedure has been reviewed and approved, that the procedure can be utilized in the field for official testing.
- 6.3 Fast Charging - The use of specially designed charging equipment which is capable of returning large amounts of energy to the battery in a short time. A Level III charger.
- 6.4 Fifth Wheel - A calibrated mechanical or optical instrument used to measure a vehicle's speed and distance independent of the vehicles on-board systems.
- 6.5 Gross Vehicle Weight Rating (GVWR) - The maximum design loaded weight of the vehicle specified by the manufacturer.
- 6.6 Initial Conditions - Conditions that exist prior to or when an event occurs.
- 6.7 Initial State of Charge (SOC) - Initial State of Charge is the SOC at the beginning of a test. It does not have to be 100%.
- 6.8 Level III Charger - A charger capable of returning 40% charge in less than 15 minutes.
- 6.9 Prerequisites - Requirements that must be met or resolved prior to an event occurring.
- 6.10 Program Manager - As used in this procedure, the individual within Electric Transportation Applications responsible for oversight of the EV America Performance Test Program. [Subcontract organizations may have similarly titled individuals, but they are not addressed by this procedure.]
- 6.11 Rapid Charger - A Level III charger. Also called a Fast Charger.
- 6.12 Shall - This word is used to indicate an item which requires adherence without deviation. Shall statements identify binding requirements. A go, no-go criterion.
- 6.13 Should - This word is used to identify an item which requires adherence if at all possible. Should statements identify preferred conditions.
- 6.14 State of Charge (SOC) - For this testing, the SOC of a battery is defined as the expected residual battery capacity, expressed in amperes-hours or watt-hours or miles, as a percentage of the total available. The 100% SOC basis (available ampere-hours, kilowatt hours or miles) is determined by the actual discharge capability of the main propulsion battery when discharged to the requirements of the 45 mph Constant Speed Range Test portion of procedure ETA-TP004.

6.0 GLOSSARY (continued)

- 6.15 Test Director - The individual within Electric Transportation Applications responsible for all testing activities associated with the EV America Performance Test Program.
- 6.16 Test Director's Log - Also called the Test Manager's Log. A daily diary kept by the Test Director, Program Manager, Test Manager or Test Engineer to document major activities and decisions that occur during the conduct of a Performance Test Evaluation Program. This log is normally a running commentary, utilizing timed and dated entries to document the days activities. This log is edited to develop the Daily Test Log published with the final report for each vehicle.
- 6.17 Test Engineer - The individual(s) assigned responsibility for the conduct of any given test. [Each contractor/subcontractor should have at least one individual filling this position. If so, they shall be responsible for adhering to the requirements of this procedure.]
- 6.18 Test Manager - The individual within Electric Transportation Applications responsible for the implementation of the test program for any given vehicle(s) being evaluated to the requirements of the EV America Performance Test Program. [Subcontract organizations may have similarly titled individuals, but they are not addressed by this procedure.]

7.0 REFERENCES

- 7.1 EV America Technical Requirements
- 7.2 ETA-AC001, Revision 2 - "Control, Close-out and Storage of Documentation"
- 7.3 ETA-AC002, Revision 2 - "Control of Test Conduct"
- 7.4 ETA-AC004, Revision 2 - "Review of Test Results"
- 7.5 ETA-AC006, Revision 2 - "Vehicle Receipt"
- 7.6 ETA-AC007, Revision 1 - "Control of Measuring and Test Equipment"
- 7.7 ETA-TP001, Revision 2 - Road Load Measurement and Dynamometer Simulation Using Coastdown Techniques"
- 7.8 ETA-TP002, Revision 2 - "Implementation of SAE Standard J1666 May 93, Electric Vehicle Acceleration, Gradeability and Deceleration Test Procedure"
- 7.9 ETA-TP004, Revision 4 - "Electric Vehicle Constant Speed Range Tests"
- 7.10 ETA-TP005, Revision 2 - "Electric Vehicle Rough Road Course"
- 7.11 ETA-TP008, Revision 2- "Battery Charging"
- 7.12 ETA-TP011, Revision 1 - "Receipt Verification"
- 7.13 ETA-TP013, Revision Draft – "Rapid Charge Requirements"
- 7.14 SAE Standard J227a

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**APPENDIX-A
Day 1 Range and Charge
Data Sheet (Page 1 of 2)**

VIN: _____

Project No.:	Test Date(s):
Root File No.:	
Test Driver:	(Initials) (Date)
Test Engineer:	(Initials) (Date)

Vehicle Setup

VEHICLE WEIGHTS AS TESTED WITH DRIVER & INSTRUMENTATION (Curb weight plus 332 pounds)			
Left Front: (lbs or kg)	Right Front: (lbs or kg)	Total Front: (lbs or kg)	Percent Front: %
Left Rear: (lbs or kg)	Right Rear: (lbs or kg)	Total Rear: (lbs or kg)	Percent Rear: %
		Total Weight: (lbs or kg)	
INSTALLED TIRES (Placard or sidewall whichever is less)			
Preparation Area Temperature: (°F or °C)			
Left Front		Right Front	
Pressure: (psi or kPa)		Pressure: (psi or kPa)	
Left Rear		Right Rear	
Pressure: (psi or kPa)		Pressure: (psi or kPa)	

Track/Weather Conditions

Test Track Location:	Track Grade: %
Ambient Temperature (initial): (40-100°F or 5-38°C)	Ambient Temperature (final): (40-100°F or 5-38°C)
Track Temperature (initial): (°F or °C)	Track Temperature (final): (°F or °C)
Wind Velocity (initial): (<10 mph or 16 km/h)	Wind Velocity (final): (<10 mph or 16 km/h)
Wind Direction (initial): °	Wind Direction (completion): °

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**APPENDIX-B
Day 2 Range and Charge
Data Sheet (Page 1 of 2)**

VIN: _____

Project No.:	Test Date(s):
Root File No.:	
Test Driver:	(Date)
(Initials)	(Date)
Test Engineer:	(Date)
(Initials)	(Date)

Vehicle Setup

VEHICLE WEIGHTS AS TESTED WITH DRIVER & INSTRUMENTATION (Curb weight plus 332 pounds)			
Left Front: (lbs or kg)	Right Front: (lbs or kg)	Total Front: (lbs or kg)	Percent Front: %
Left Rear: (lbs or kg)	Right Rear: (lbs or kg)	Total Rear: (lbs or kg)	Percent Rear: %
		Total Weight: (lbs or kg)	
INSTALLED TIRES (Placard or sidewall whichever is less)			
Preparation Area Temperature: (°F or °C)			
Left Front		Right Front	
Pressure: (psi or kPa)		Pressure: (psi or kPa)	
Left Rear		Right Rear	
Pressure: (psi or kPa)		Pressure: (psi or kPa)	

Track/Weather Conditions

Test Track Location:	Track Grade: %
Ambient Temperature (initial): (40-100°F or 5-38°C)	Ambient Temperature (final): (40-100°F or 5-38°C)
Track Temperature (initial): (°F or °C)	Track Temperature (final): (°F or °C)
Wind Velocity (initial): (<10 mph or 16 km/h)	Wind Velocity (final): (<10 mph or 16 km/h)
Wind Direction (initial): °	Wind Direction (completion): °

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**APPENDIX-C
Day 3 Range and Charge
Data Sheet (Page 1 of 2)**

VIN: _____

Project No.:	Test Date(s):
Root File No.:	
Test Driver:	(Date)
(Initials)	(Date)
Test Engineer:	(Date)
(Initials)	(Date)

Vehicle Setup

VEHICLE WEIGHTS AS TESTED WITH DRIVER & INSTRUMENTATION (Curb weight plus 332 pounds)			
Left Front: <small>(lbs or kg)</small>	Right Front: <small>(lbs or kg)</small>	Total Front: <small>(lbs or kg)</small>	Percent Front: %
Left Rear: <small>(lbs or kg)</small>	Right Rear: <small>(lbs or kg)</small>	Total Rear: <small>(lbs or kg)</small>	Percent Rear: %
		Total Weight: <small>(lbs or kg)</small>	
INSTALLED TIRES (Placard or sidewall whichever is less)			
Preparation Area Temperature: <small>(°F or °C)</small>			
Left Front		Right Front	
Pressure: <small>(psi or kPa)</small>		Pressure: <small>(psi or kPa)</small>	
Left Rear		Right Rear	
Pressure: <small>(psi or kPa)</small>		Pressure: <small>(psi or kPa)</small>	

Track/Weather Conditions

Test Track Location:	Track Grade: %
Ambient Temperature (initial): <small>(40-100°F or 5-38°C)</small>	Ambient Temperature (final): <small>(40-100°F or 5-38°C)</small>
Track Temperature (initial): <small>(°F or °C)</small>	Track Temperature (final): <small>(°F or °C)</small>
Wind Velocity (initial): <small>(<10 mph or 16 km/h)</small>	Wind Velocity (final): <small>(<10 mph or 16 km/h)</small>
Wind Direction (initial): °	Wind Direction (completion): °

Electric Transportation Applications

**APPENDIX-D
Calibration of Vehicle
Speedometer Test Data Sheet
(Page 1 of 1)**

VIN: _____

Sequence No:	File No.:	Direction of Travel:
Time (initial):		Time (final):
Odometer (initial): <small>(miles or kilometers)</small>		Odometer (final): <small>(miles or kilometers)</small>
Status of Charge (initial): <small>(SOC,KWH,AH)</small>		Status of Charge (final): <small>(SOC,KWH,AH)</small>
DAS Heads-up Display:		Vehicle Speedometer:
0 MPH		
5 MPH		
10 MPH		
15 MPH		
20 MPH		
25 MPH		
30 MPH		
35 MPH		
40 MPH		
45 MPH		
50 MPH		
55 MPH		
60 MPH		
70 MPH		
80 MPH		
MPH		
MPH		
Comments (initials/date):		
Completed By:		
<small>(Printed Name)</small>	<small>(Signature)</small>	<small>(Date)</small>
Reviewed By:		
<small>(Printed Name)</small>	<small>(Signature)</small>	<small>(Date)</small>
Approved By:		
<small>(Printed Name)</small>	<small>(Signature)</small>	<small>(Date)</small>

Electric Transportation Applications

**APPENDIX-E
Vehicle Metrology Setup Sheets
(Page 1 of 1)**

VIN: _____

Instrument/Device:	Calibration Due Date:	Initials / Date:
Fifth Wheel S/N:		
Fifth Wheel Calibrator S/N:		
DAS S/N:		
DAS Set-up Sheet S/N		
kWh Meter S/N:		
Shunt S/N:		
Tire Pressure Gauge S/N:		
Misc:		
Misc:		
Misc:		
Misc:		
Comments (initials/date):		
Completed By:		
(Printed Name)	(Signature)	(Date)
Reviewed By (QA):		
(Printed Name)	(Signature)	(Date)
Approved By:		
(Printed Name)	(Signature)	(Date)