

ETA-GTP002

Revision 1
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Traction System Test

Prepared by

Electric Transportation Applications

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1 Objective

This procedure identifies the proper method for conducting tests and evaluation of the traction system of an electric pushback tractor being tested during the eGSEV America Performance Test Program. It shall not supersede the testing protocols of the vehicle's manufacturer, nor is it meant to supersede those specifically addressed by SAE test standards, nor of any regulatory agency that may have or exercise control over the covered activities.

2 Purpose

The purpose of this procedure is to provide guidance on testing and evaluating the traction system during the time the electric pushback tractor is being subjected to the eGSEV America Performance Test Program. This activity is meant to test the vehicle as a total system. Tests of specific subsystems or portions of individual subsystems are addressed by other test procedures, as appropriate. This testing and data acquisition meets the requirements specified in the eGSEV America Technical Requirements.

3 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-GAC004, "Review of Test Results." Storage and retention of records during and following testing activities shall be completed as described in ETA-GAC001, "Control, Close-out, and Storage of Documentation."

4 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 appropriate 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 Director, or Test Manager prior to commencing any testing activities.
- 4.2 Ambient temperature during testing shall be >40°F (>5°C).

- 4.3 Battery temperatures at the beginning of testing shall be within a range of 60°F to 120°F (16°C to 49°C). Record in Appendix A.
- 4.4 Testing shall be completed on a surface suitable for applying maximum traction force without allowing premature tire slip.
- 4.5 Vehicles shall be tested in their normal configuration with normal standard equipment, appendages, and accessories.
- 4.6 Supplier's recommended lubricants shall be employed.
- 4.7 Accessories not required for safe operation shall not be used or operated during testing.
- 4.8 For tests requiring a battery at X% SOC at the start of testing, the required initial SOC will be established as follows:
 - 4.8.1 The battery shall be fully charged to the requirements of the battery supplier until the battery is at 100% SOC.
 - 4.8.2 The battery energy capacity shall be obtained from the Battery Capacity Test completed as part of ETA-GTP003, "Battery Capacity and Depth of Discharge Test."
 - 4.8.3 To achieve X% SOC, the battery will be discharged by operating the vehicle at the test location until 1-X% capacity, measured in ampere-hours or kilowatt-hours, have been removed from the battery. If operation of the vehicle to discharge the battery as required is not practical, another suitable method of discharging the battery will be determined and approved by the Program Manager.
- 4.9 The overall error of recording or indicating instruments shall not exceed $\pm 2\%$ of the maximum value of the attribute being measured. Periodic calibration shall be performed and documented to ensure compliance with this requirement.
- 4.10 Complete or verify ETA-GTP001, "Vehicle Verification," and ETA-GAC006, "Receipt Inspection," have been completed for the vehicle being tested.
- 4.11 The road surface type and condition (SAE J688) and lengths of test route shall be recorded in Appendix A.

- 4.12 For instrumentation used in the test, at a minimum, record the following information for each instrument in Appendix B:
 - 4.12.1 Supplier
 - 4.12.2 Model number
 - 4.12.3 Serial number
 - 4.12.4 Last calibration date
 - 4.12.5 Next calibration date
- 4.13 Any deviation from the test procedure and the reason for the deviation shall be recorded in accordance with ETA-GAC002, "Control of Test Conduct."
- 4.14 Speed-time measuring devices and other necessary equipment shall be installed in a manner that does not hinder vehicle operation or alter the operating characteristics of the vehicle.
- 4.15 All steps shall be completed in the order written. Deviations from any step or requirement must have the prior written approval of the Program Manager, Test Director, or Test Manager in accordance with Procedure ETA-GAC002.
- 4.16 All documentation required to complete the testing identified in the contract/proposal/technical guidelines shall be completed, approved, and issued prior to the effective date of the procedure. In no case shall the procedure be utilized for official testing or data collection prior to its effective date.
- 4.17 Testing MAY take place over the course of several days. Page 1 of Appendix A shall be completed for each day testing is commenced.

5 Testing Activity

These tests evaluate and verify the operation of the tractor traction system for safety and dynamic performance as required by the eGSEV America Technical Specification.

NOTE:

During this testing, if a vehicle fails electrically or mechanically for any reason other than a propulsion battery reaching its design depth of discharge (DOD) limit, testing of the vehicle shall be halted and the vehicle removed from the test program until the supplier has affected repairs. See ETA-GAC002 for additional details.

5.1 Test Preparation

Instrument the vehicle to obtain the following data:

- 5.1.1 Speed versus time
- 5.1.2 Distance versus time
- 5.1.3 Tractive force, up to 125% of the maximum force specified by the manufacturer
- 5.1.4 Battery current
- 5.1.5 Battery voltage
- 5.1.6 Battery temperature.

5.2 Ambient Conditions

Record the following environmental conditions in Appendix A:

- 5.2.1 Range of ambient temperature during the test
- 5.2.2 Precipitation.

5.3 Safety Interlock Tests

- 5.3.1 Verify the traction battery is at 100% SOC. If not, charge the battery to achieve full charge in accordance with the manufacturer's instructions.
- 5.3.2 It shall not be possible to drive the tractor when the tractor is connected to the charger. Verify this requirement by performing the following:
 - 5.3.2.1 Verify the charger is connected to the vehicle as per the manufacturer's instructions.
 - 5.3.2.2 With an operator sitting in the driver's seat, verify the vehicle drive selector is in the "Park" or "Neutral" position.
 - 5.3.2.3 Verify the key switch is "Off."
 - 5.3.2.4 Turn the key switch to the "On" position.
 - 5.3.2.5 Apply the service brake and release the handbrake, if any.
 - 5.3.2.6 Place the vehicle drive selector in the "Forward" position.
 - 5.3.2.7 Release the service brake. If the vehicle moves, the requirement has not been met.
 - 5.3.2.8 Actuate the accelerator pedal. If the vehicle moves, the requirement has not been met.

- 5.3.2.9 Repeat Steps 5.3.2.3 through 5.3.2.8 and place the drive selector in the “Reverse” position.
- 5.3.3 This test is to be performed only if the vehicle is equipped with a handbrake. The tractor shall be equipped with a handbrake interlock. Verify this requirement by performing the following:
 - 5.3.3.1 With an operator sitting in the driver’s seat, verify the vehicle drive selector is in the "Park" or "Neutral" position.
 - 5.3.3.2 Verify the key switch is “Off.”
 - 5.3.3.3 Verify the handbrake is applied.
 - 5.3.3.4 Apply the service brake.
 - 5.3.3.5 Turn the key switch to the “On” position.
 - 5.3.3.6 Place the vehicle drive selector in the “Forward” position.
 - 5.3.3.7 Release the service brake. If the vehicle moves, the requirement has not been met.
 - 5.3.3.8 Actuate the accelerator pedal. If the vehicle moves, the requirement has not been met.
 - 5.3.3.9 Repeat Steps 5.3.3.1 through 5.3.3.8 and select the “Reverse” position of the drive selector.
- 5.3.4 The tractor shall be equipped with a dead man-type seat switch interlock that de-activates the traction circuit whenever the operator is not on the seat. This test must be performed with no weight on the driver’s seat. Verify this requirement by performing the following:
 - 5.3.4.1 With the driver’s seat empty, verify the vehicle drive selector is in the "Park" or "Neutral" position.
 - 5.3.4.2 Verify the key switch is “Off.”
 - 5.3.4.3 Turn the key switch to the “On” position.
 - 5.3.4.4 Apply the service brake and release the handbrake, if any.
 - 5.3.4.5 Place the vehicle drive selector in the “Forward” position.
 - 5.3.4.6 Release the service brake. If the vehicle moves, the requirement has not been met.
 - 5.3.4.7 Actuate the accelerator pedal. If the vehicle moves, the requirement has not been met.

- 5.3.4.8 Repeat Steps 5.3.3.2 through 5.3.3.7 and place the drive selector in the “Reverse” position.
- 5.3.4.9 Repeat Steps 5.3.3.1 through 5.3.3.8 with an operator in the driver’s seat. If the traction system is not disabled within 2 seconds of the operator completely removing his/her weight from the driver’s seat, then the requirement has not been met.
- 5.3.4.10 If at any time during this test the vehicle stalls or stops running while the operator is sitting on the seat, then the requirement has not been met.

CAUTION:

Verification of Step 5.3.5 requires movement of the vehicle. Personnel shall exercise extreme caution when performing the following steps.

- 5.3.5 The traction system controller shall incorporate a “static return to off” feature. Verify this requirement by performing the following:
 - 5.3.5.1 With an operator in the driver’s seat, verify the vehicle drive selector is in the "Reverse" or "Forward" position.
 - 5.3.5.2 Verify the key switch is “Off.”
 - 5.3.5.3 Turn the key switch to the “On” position.
 - 5.3.5.4 Apply the service brake and release the handbrake, if any.
 - 5.3.5.5 Release the service brake. If the vehicle moves, the requirement has not been met.
 - 5.3.5.6 Turn the key switch to “Off.”
 - 5.3.5.7 Select “Park” or “Neutral” on the drive selector.
 - 5.3.5.8 Apply the service brake.
 - 5.3.5.9 Turn the key switch to “On.”
 - 5.3.5.10 Release the service brake.
 - 5.3.5.11 Actuate the accelerator pedal to get the tractor moving.
 - 5.3.5.12 Remove the operator from the driver’s seat.
 - 5.3.5.13 Once the dead man function activates, reseal the driver and apply the service brake to bring the vehicle to a stop.

- 5.3.5.14 Release the service brake. If the vehicle moves, the requirement has not been met.
- 5.3.5.15 Actuate the accelerator pedal. If the vehicle moves, the requirement has not been met.
- 5.3.6 Vehicles using HIGH VOLTAGE traction systems shall be equipped with a “master” switch that shall interlock controller propulsion function and battery contactor(s), if any, to render the propulsion system inoperative. Verify this requirement by performing the following:
 - 5.3.6.1 Locate the “master” switch from the manufacturer’s documentation.
 - 5.3.6.2 Operate (e.g., remove or turn as directed by the manufacturer’s instructions) the “master” switch to the off position.
 - 5.3.6.3 With an operator in the driver’s seat, attempt to turn the vehicle on. If the “master” switch is the keyswitch, then leave the keyswitch in the off position.
 - 5.3.6.4 Place the drive selector in “Forward.”
 - 5.3.6.5 Release the service brake. If the vehicle moves, the requirement has not been met.
 - 5.3.6.6 Actuate the accelerator pedal. If the vehicle moves, the requirement has not been met.
- 5.3.7 A manual service disconnect for vehicles using a HIGH VOLTAGE traction system also shall be required.
 - 5.3.7.1 Identify the manual disconnect switch from the manufacturer’s supplied information.
 - 5.3.7.2 Operate the manual disconnect switch to disable the traction system per the manufacturer’s instructions.
 - 5.3.7.3 Turn the master switch (see Section 5.3.6) to the on position.
 - 5.3.7.4 If equipped, turn the keyswitch to the on position.
 - 5.3.7.5 Release the parking brake, apply the service brake, and place the drive selector in the “Forward” position.
 - 5.3.7.6 Actuate the accelerator pedal.
 - 5.3.7.7 If the vehicle moves, the requirement has not been met.

- 5.3.8 A propulsion power system operating at greater than 60 volts shall be isolated from the vehicle chassis such that leakage current does not exceed 20 mA with the battery connected.
 - 5.3.8.1 The battery shall be fully charged to the requirements of the battery Supplier until the battery is at 100% State of Charge (see ETA-GTP005, Section 5.6).
 - 5.3.8.2 Using the methods described in UL-2232-1 and 2232-2, measure and record the battery-to-chassis leakage current.

5.4 Dynamic Tests

CAUTION:

Conduct of the tests in section 5.4 requires movement of the vehicle under load. Personnel shall exercise extreme caution when performing the following steps.

- 5.4.1 The maximum tractor speed with no towed load shall be a minimum of 5 miles per hour. Verify this requirement by performing the following:
 - 5.4.1.1 With the battery at 100% SOC (see ETA-GTP005, Section 5.6), operate the tractor in a straight line on a level course with full accelerator pedal input in the “Forward” direction for 30 seconds. If the driving course is not sufficiently long to allow for 30 seconds of operation, operate the vehicle for as long as possible at maximum speed, but not less than 10 seconds.

NOTE:

If the vehicle is equipped with regenerative braking, the regenerative braking system shall be engaged during this test. If the level of regenerative braking can be adjustable by the driver, it shall be set to the maximum value of regenerative.

- 5.4.1.2 Apply the service brakes to bring the vehicle to a rapid halt. If the vehicle does not track straight or otherwise behaves in an unstable manner, then the tractor has not met the requirements of Step 3.2.2.9 of the Technical Specification. Note any comments in Appendix A.
- 5.4.1.3 Repeat Steps 5.4.1.1 through 5.4.1.2 in the “Reverse” direction.
- 5.4.1.4 Discharge the battery to 50% SOC as directed in Section 4.8.

- 5.4.1.5 Repeat Steps 5.4.1.1 through 5.4.1.3.
- 5.4.1.6 If, in any of the above conditions, the tractor did not achieve and sustain a speed of 12 mph, the requirement has not been met.
- 5.4.2 The manufacturer shall report the maximum static drawbar pull, with the traction battery at 100% and 50% (+/- 10%) state of charge. Verify this requirement by performing the following:
 - 5.4.2.1 Confer with the tractor manufacturer for their recommended procedure for conducting a static drawbar test. In lieu of specific recommendations, proceed with the rest of the procedure as presented here.
 - 5.4.2.2 Locate or install a post, bollard, or other fixed body that will safely handle 150% of the maximum static drawbar force specified by the manufacturer.
 - 5.4.2.3 Install a load cell (or other suitable scale) with a maximum limit of 150% of the specified static drawbar load to either the fixed body or tractor.
 - 5.4.2.4 Using equipment designed to safely handle 150% of the specified load (e.g., chains, straps, ropes, cables), connect the tractor and load cell to the fixed body.
 - 5.4.2.5 Operate the tractor with maximum accelerator input for a minimum of 15 seconds. Note any tire slip that occurs in Appendix A. Repeat two more times.
 - 5.4.2.6 Using the data collected, find the most stable 10-second period for the drawbar force and calculate an average value.
 - 5.4.2.7 If the average drawbar force for all three pulls falls below the manufacturer's specified value, then the requirement has not been met.
 - 5.4.2.8 If the tractor is designed to operate in both directions, repeat Steps 5.4.2.5 through 5.4.2.7 with the tractor oriented in the opposite direction.
 - 5.4.2.9 Discharge the battery to 50% SOC as directed in Section 4.8.
 - 5.4.2.10 Repeat Steps 5.4.2.4 through 5.4.2.8.
- 5.4.3 The manufacturer shall report the maximum drawbar of the tractor at a speed of 4.0 miles per hour (6.0 kilometers per hour) with the traction battery at 100% and at 50% (+/- 10%) state of charge. The traction

system shall be capable of continuous operation at 4.0 mph for at least 3 minutes without overheating or damage to the propulsion system. Verify this requirement by performing the following:

- 5.4.3.1 Confer with the tractor manufacturer for their recommended procedure for conducting a dynamic drawbar test. In lieu of specific recommendations, proceed with the rest of the procedure as presented here.
- 5.4.3.2 Using equipment rated to carry 150% of the manufacturer's specified load, attach the tractor and load cell to a simulated load that will allow the tractor to develop maximum specified drawbar force.
- 5.4.3.3 With the battery at 100% state of charge (see ETA-GTP003, Section 5.3), operate the tractor in a straight line on level ground at 4.0 mph ($\pm 10\%$) for at least 15 seconds.
- 5.4.3.4 If track length permits, continue operating tractor at maximum load for a total of 3 minutes. If any drive system component overheats or is damaged during the test, then the requirement given in Section 4.5 of the Technical Specification has not been met. If the track is insufficiently long to conduct this test for 3 minutes, then run at least 3 back-to-back runs per Step 5.4.3.3 with as little rest time as possible. Otherwise, an alternative test procedure must be determined and approved by the Program Manager.
- 5.4.3.5 Using the data collected during the test, determine the most stable 10-second period and calculate the average drawbar force for that period.
- 5.4.3.6 If the average drawbar force calculated in Step 5.4.3.5 falls below the manufacturer's specified value by more than 5%, the requirement given in Section 4.4 of the Technical Specification has not been met.
- 5.4.3.7 If the tractor is designed to operate in both directions, repeat Steps 5.4.3.2 through 5.4.3.6 (except the 3-minute durability run) with the tractor oriented in the opposite direction.
- 5.4.3.8 Discharge the battery to 50% SOC as directed in Section 4.8
- 5.4.3.9 Repeat Steps 5.4.3.2 through 5.4.3.7 (except the 3-minute durability run).

- 5.4.4 Record the following information in Appendix A:
 - 5.4.4.1 Date and time of test completion
 - 5.4.4.2 Equipment failures, if any
 - 5.4.4.3 Equipment abnormalities, if any
 - 5.4.4.4 Driver notes, if any
 - 5.4.4.5 Any indications of propulsion system overheating.

6 Glossary

- 6.1 Effective Date - After a procedure has been reviewed and approved, the first date the procedure can be utilized the official data collection and testing.
- 6.2 Fifth Wheel - A calibrated mechanical instrument used to measure a vehicle's speed and distance independent of the vehicles onboard systems.
- 6.3 Initial Conditions - Conditions that must exist prior to an event occurring.
- 6.4 Initial State of Charge (SOC) - The residual capacity of a battery after a discharge (full or partial) expressed as a percent of the total battery energy capacity. May be portrayed in ampere-hours, miles, or kilowatt-hours. Initial SOC is the SOC at the beginning of a test.
- 6.5 Prerequisites - Requirements that must be met or resolved prior to an event occurring.
- 6.6 Program Manager - As used in this procedure, the individual within Electric Transportation Applications responsible for oversight of the Neighborhood Electric Vehicle (NEV) America Performance Test Program. [Subcontract organizations may have similarly titled individuals, but they are not addressed by this procedure.]
- 6.7 Shall - This word is used to indicate an item that requires adherence without deviation. Shall statements identify binding requirements. A go, no-go criterion.
- 6.8 Should - This word is used to identify an item that requires adherence if at all possible. Should statements identify preferred conditions.
- 6.9 Summary Data Sheet - A stylized presentation of test results in the form shown in ETA-GTP003, Revision 0, Appendix A.

- 6.10 Test Director - The individual within Electric Transportation Applications responsible for all testing activities associated with the NEV America Performance Test Program.
- 6.11 Test Director'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 day's activities. This log is edited to develop the Daily Test Log that is published with the final report for each vehicle.
- 6.12 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.]
- 6.13 Test Manager - The individual within Electric Transportation Applications responsible for implementation of the test program for any given vehicle(s) being evaluated to the requirements of the NEV America Performance Test Program. [Subcontract organizations may have similarly titled individuals, but they are not addressed by this procedure.]

7 References

- eGSEV America Vehicle Technical Specification Revision 0, December 1, 2005
- ETA-GAC001, "Control, Close-out, and Storage of Documentation"
- ETA-GAC002, "Control of Test Conduct"
- ETA-GAC004, "Review of Test Results"
- ETA-GAC006, "Receipt Inspection"
- ETA-GTP001, "Vehicle Verification"
- ETA-GTP003, "Battery Capacity and Depth of Discharge Test"
- ETA-GTP005, "Battery Charger Performance"
- UL-2232 Parts 1 and 2, "Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits"

Appendix A, Traction System Test Data Sheet

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Vehicle Number: _____

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

Track/Weather Conditions

Test Track Location:	Surface Type:	Track Grade: %
Ambient Temperature (initial): <small>(≥40°F or 5°C)</small>	Ambient Temperature (final): <small>(≥40°F or 5°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): °	

Appendix A, Traction System Test Data Sheet

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Test Data Sheet (Maximum No-Load Speed, 100%)

Sequence No: 1	File No.:	Direction of Travel:
Time (initial):		Time (final):
Status of Charge (initial): <small>(SOC,kWh,Ah)</small>		Status of Charge (final): <small>(SOC,kWh,Ah)</small>
Battery Temp (initial): <small>(60-120°F or 16-49°C)</small>		Battery Temp (final): <small>(°F or °C)</small>
Comments (initials/date):		
<p>Maximum No-Load Speed Attained: _____</p>		

Appendix A, Traction System Test Data Sheet (Page 3 of 8)

Test Data Sheet (Maximum No-Load Speed, 50%)

Sequence No: 2	File No.:	Direction of Travel:
Time (initial):		Time (final):
Status of Charge (initial): <small>(SOC,kWh,Ah)</small>		Status of Charge (final): <small>(SOC,kWh,Ah)</small>
Battery Temp (initial): <small>(°F or °C)</small>		Battery Temp (final): <small>(°F or °C)</small>
Comments (initials/date):		
<p>Maximum No-Load Speed Attained: _____</p>		

Appendix A, Traction System Test Data Sheet (Page 4 of 8)

Test Data Sheet (Maximum Static Drawbar Force, 100% SOC)

Sequence No: 3	File No.:	
Time (initial):		Time (final):
Status of Charge (initial): <small>(SOC,kWh,Ah)</small>		Status of Charge (final): <small>(SOC,kWh,Ah)</small>
Battery Temp (initial): <small>(°F or °C)</small>		Battery Temp (final): <small>(°F or °C)</small>
Comments (initials/date): Manufacturer's stated maximum static drawbar force: _____ Average static drawbar force, first pull: _____ Average static drawbar force, second pull: _____ Average static drawbar force, third pull: _____ Average static drawbar force: _____		

Appendix A, Traction System Test Data Sheet (Page 5 of 8)

Test Data Sheet (Maximum Static Drawbar Force, 50% SOC)

Sequence No: 4	File No.:	
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>
Battery Temp (initial): <small>(°F or °C)</small>		Battery Temp (final): <small>(°F or °C)</small>
Comments (initials/date): Manufacturer's stated maximum static drawbar force: _____ Average static drawbar force, first pull: _____ Average static drawbar force, second pull: _____ Average static drawbar force, third pull: _____ Average static drawbar force: _____		

Appendix A, Traction System Test Data Sheet (Page 6 of 8)

Test Data Sheet (Maximum Dynamic Drawbar Force, 100% SOC)

Sequence No: 5	File No.:	
Time (initial):		Time (final):
Status of Charge (initial): <small>(SOC,kWh,Ah)</small>		Status of Charge (final): <small>(SOC,kWh,Ah)</small>
Battery Temp (initial): <small>(°F or °C)</small>		Battery Temp (final): <small>(°F or °C)</small>
Comments (initials/date):		
<p>Manufacturer's stated maximum dynamic drawbar force: _____</p> <p>Average dynamic drawbar force, first pull: _____</p> <p>Average dynamic drawbar force, second pull: _____</p> <p>Average dynamic drawbar force: _____</p>		

Appendix A, Traction System Test Data Sheet (Page 7 of 8)

Test Data Sheet (Maximum Dynamic Drawbar Force, 50% SOC)

Sequence No: 6	File No.:	
Time (initial):		Time (final):
Status of Charge (initial): <small>(SOC,kWh,Ah)</small>		Status of Charge (final): <small>(SOC,kWh,Ah)</small>
Battery Temp (initial): <small>(°F or °C)</small>		Battery Temp (final): <small>(°F or °C)</small>
Comments (initials/date): Manufacturer's stated maximum dynamic drawbar force: _____ Average dynamic drawbar force, first pull: _____ Average dynamic drawbar force, second pull: _____ Average dynamic drawbar force: _____		

Appendix B, Vehicle Metrology Setup Sheets

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Vehicle Number: _____

Instrument/Device	Calibration Due Date	Initials / Date
Fifth Wheel S/N:		
Fifth Wheel Calibrator S/N:		
DAQ S/N:		
DAQ Setup Sheet S/N		
kWh Meter S/N:		
Shunt S/N:		
Tire Pressure Gauge S/N:		
Accelerometer:		
Misc:		
Misc:		
Misc:		
Comments (initials/date):		
Completed By:		
<small>(Printed Name)</small>	<small>(Signature)</small>	<small>(Date)</small>
Reviewed By (QA):		
<small>(Printed Name)</small>	<small>(Signature)</small>	<small>(Date)</small>
Approved By:		
<small>(Printed Name)</small>	<small>(Signature)</small>	<small>(Date)</small>