

# ETA-HAC07

Revision 0

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## Control of Measuring and Test Equipment (M&TE)

Prepared by

*Electric Transportation Applications*

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## 1.0 Objective

The objective of this procedure is to assure that Measuring and Test Equipment (M&TE) used for HEV America is properly functioning and accurately calibrated. These methods are not meant to supersede those of the testing facility, those specifically mandated by governmental regulations, 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 control of M&TE. This includes requirements for calibration of M&TE, control of the standards, services and resources needed for the calibration processes and the use of external resources for calibration activities. This procedure also satisfies the requirements for these activities as specified in procedure ETA-HQP001, "Quality Program."

## 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, it will 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 documentation shall be in accordance with ETA-HAC04, "Review of Test Results." Storage and retention of records during and following testing activities will be completed as described in Procedure ETA-HAC01, "Control, Close-out and Storage of Documentation."

## 4.0 Initial Conditions and Prerequisites

- 4.1 This program is applicable to all M&TE utilized for data collection purposes, modified as follows:
  - 4.1.1 Vendor's M&TE that meets the requirements of a formal program administered by that vendor and subject to audit under the requirements of procedure ETA-HQA01, shall be considered to meet the requirements of this procedure.
  - 4.1.2 Devices such as rulers, tape measures, laboratory glassware, volumetric transfer equipment, and other similar devices used in applications where normal commercial accuracy is acceptable shall be accepted at face value. There shall be no further requirement for control of these

- items as long as they are controlled in a manner that precludes their use in conditions other than as noted.
- 4.1.3 Equipment that is permanently installed and used in applications not requiring other than normal commercial accuracy (similar to that noted in 4.1.2).
  - 4.1.3 Equipment controlled or regulated by agencies outside the control of Electric Transportation Applications (such as the equipment regulated by the Federal Communications Commission).
- 4.2 All calibration activities and resources shall be traceable to the National Institute of Standards and Technology (NIST), or to standards nationally recognized and commensurate with the desired usage. If an appropriate standard exists, calibration bases shall be identified and documented.

## 5.0 Activity Requirements

The requirements of this procedure apply to the activities listed here and to the personnel responsible for implementing them. Activities that are not listed or identified herein shall not be considered exempted by their absence, as long as their required function or use is controlled by this activity.

- 5.1 Equipment Indexing
  - 5.1.1 All equipment maintained for use and data collection and/or processing by Electric Transportation Applications shall be formally identified, numbered and indexed.
  - 5.1.2 Equipment shall be cross referenced to other associated equipment (e.g., calibrated meter probes shall reference the meter with which they are used and calibrated).
  - 5.1.3 Cross references shall contain the applicable Certificates of Conformance, and identify the calibration standards and associated M&TE, when appropriate.
- 5.2 Calibration Labeling
  - 5.2.1 M&TE equipment shall be labeled, tagged or otherwise controlled to indicate its calibration status and ensure its traceability to calibration test data.
    - 5.2.1.1 Labeling shall be plainly visible and as a minimum should contain:
      - 5.2.1.1.1 The equipment serial number
      - 5.2.1.1.2 The most current calibration date

5.2.1.1.3 The next required calibration due date.

### 5.3 Intervals of Calibration

5.3.1 Measuring and test equipment (M&TE) should be calibrated at specified intervals, on should be based on the item's:

5.3.1.1 Required accuracy

5.3.1.2 Intended use

5.3.1.3 Frequency of use

5.3.1.4 Stability characteristics

5.3.1.5 Any other conditions affecting it's performance

5.3.2 Calibration shall be according to pre-planned equipment schedules based upon an annual/biannual cycle. Frequencies may be increased dependent upon equipment sensitivity and use.

5.3.3 An Instrument Calibration list shall be maintained and shall contain the following minimum information:

5.3.3.1 Equipment Type

5.3.3.2 Equipment Description

5.3.3.3 Manufacturer

5.3.3.4 Manufacturer's model number

5.3.3.5 Manufacturer's serial number

5.3.3.6 Electric Transportation Application's index number

5.3.3.7 Calibration status

5.3.3.8 Last calibration date

5.3.3.9 Calibration due date

### 5.4 Calibration Requirements

5.4.1 M&TE shall be calibrated against standards which provide an accuracy closer than the required tolerances of the equipment being calibrated. [If a meter has a stated accuracy of 0.5% of full scale, the calibration standard shall not have the result of reducing that stated accuracy.] If nationally recognized standards exist, calibration standards shall be traceable to such standards.

5.5 Documentation Requirements

5.5.1 Documents related to calibration activities shall be maintained and controlled in accordance with the requirements of procedure ETA-HAC001, “Control, Close-out and Storage of Documentation.”

5.6 Personnel Qualifications

5.6.1 Personnel who perform calibrations or review and/or approve calibrations shall be certified in accordance with procedure ETA-HAC05, “Training and Certification Requirements for Personnel Utilizing ETA Procedures”.

5.7 Environmental Controls

5.7.1 All calibration standards shall be maintained, calibrated, transported, used and stored in environments required by the calibration standards governing the particular calibration requirements (e.g., NIST, QAM, ISO-900X). which will not adversely affect their accuracy.

5.7.2 All M&TE shall be maintained within the environmental parameters specified by the particular manufacturer. This applies to calibration, storage and use.

5.8 Non-Conforming Equipment

5.8.1 When M&TE is found to be out of tolerance during its periodic calibration or it is not possible to determine the calibration status due to equipment condition or location, a Non-Conforming Condition is said to exist.

5.8.1.1 The condition type and apparent cause shall be documented.

5.8.1.2 The condition shall be evaluated to determine the impact on tests completed using the non-conforming equipment since the previous calibration.

5.8.1.3 The non-conforming equipment shall be removed from further service (red tag) until:

5.8.1.3.1 The cause of the non-conformance has been corrected

5.8.1.3.2 The non-conforming equipment has been recalibrated.

5.9 Vendor’s M&TE

5.9.1 M&TE controlled by a vendor’s M&TE program need not be subject to this procedure if all of the following are met:

- 5.9.1.1 The vendor's M&TE is controlled by an approved calibration program that incorporates requirements equivalent to the requirements in this program and associated practices.
  - 5.9.1.2 The vendor maintains documentation controls for the calibration status and records of tools and gauges utilized.
  - 5.9.1.3 The vendor's program and records are available for audit.
  - 5.9.1.4 The scope of the vendor's work is clearly defined and controlled by a purchase order or contract.
- 5.10 Procurement of Outside Services
- 5.10.2 Outside services may be utilized for equipment calibration/re-calibration. Should outside facilities be utilized for the calibration of equipment controlled by this program, those facilities shall provide a calibration certificate or data sheet for each item calibrated which contains, at a minimum, the following information:
    - 5.10.2.1 Name of the item
    - 5.10.2.2 Manufacturer's serial number of item
    - 5.10.2.3 Date of the calibration
    - 5.10.2.4 A statement indicating the standards used in calibration, test numbers or other means of documenting traceability.
    - 5.10.2.5 A statement of calibration accuracy ratio(s) or a statement of the accuracy of the standard(s) used and the M&TE calibrated.
    - 5.10.2.6 A statement of the facility's calibration standards and their traceability to NIST or other nationally recognized standards.
    - 5.10.2.7 A statement of equipment conformance to the calibration specifications in the "as found" or pre-calibration condition.
    - 5.10.2.8 In the event the M&TE did not conform to the calibration specifications in the "as found" condition, a statement containing the following:
      - 5.10.2.8.1 A statement specifically defining the out-of-tolerance condition
      - 5.10.2.8.2 A statement specifically identifying the cause of the out-of-tolerance condition

5.10.2.8.3 A statement specifically identifying all of the work performed to correct the out-of-tolerance condition, including components/parts replaced.

5.10.3 Procurement activities for M&TE calibration standards and equipment shall be completed by personnel familiar with metrology requirements and who are certified to procedure ETA-HAC05, “Training and Certification Requirements for Personnel Utilizing ETA Procedures”.

5.10.4 Procurement of external services for calibration and/or repair services for M&TE shall be only from vendors who have been subjected to or agreed to an audit under the requirements of procedure ETA-HQA01.

## 6.0 Glossary

- 6.1 Accuracy - Closeness to the true or accepted (or nominal) value. See inaccuracy.
- 6.2 Calibration - comparison of a measurement standard or instrument with another standard or instrument to detect, correlate, report or eliminate by adjustment any inaccuracy of the compared.
- 6.3 Calibration Standards - The reference used to conduct a calibration. They are normally associated with a known Standard, such as NIST, ISO, etc..
- 6.4 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.
- 6.5 Measuring and Test Equipment (M&TE) - Devices or systems used to calibrate, measure, gauge, test, inspect or control in order to acquire research development, test, or operational data; to determine compliance with design, specifications or other technical requirements.
- 6.6 NIST - National Institute of Standards and Technology, formerly the National Bureau of Standards.
- 6.7 Non-Conforming M&TE - Equipment which no longer meets the calibration requirements imposed by the reference standard, and normally characterized as one of the following:
- 6.7.1 Out of Tolerance M&TE
  - 6.7.2 M&TE overdue for calibration
  - 6.7.3 M&TE that has been identified as “Out of Service”
  - 6.7.4 M&TE with unacceptable documentation



- 6.8 Out of Service M&TE - Equipment which can no longer be used because of one of the following conditions:
  - 6.8.1 M&TE that is suspected to be out of tolerance or functioning improperly
  - 6.8.2 M&TE that is out of tolerance or functioning improperly
- 6.9 Out of Tolerance Equipment - Equipment whose output is no longer reliable as characterized by one of the following:
  - 6.9.1 Equipment found with “as Found” data outside required tolerances.
  - 6.9.2 Equipment in a condition such that “As Found” data cannot be taken.
  - 6.9.3 Equipment that is lost, stolen or improperly maintained.
- 6.10 Quality Control - The procedures and activities developed and implemented to produce products/measurements of desired quality.
- 6.11 Shall - Items which require adherence without deviation. Shall statements identify binding requirements. A go, no-go criterion.
- 6.12 Should - Items which require adherence if at all possible. Should statements identify preferred conditions.
- 6.13 Tolerance - The maximum allowable departure of a standard from its nominal value.
- 6.14 Traceability - The ability to relate an individual measurement result to national standards of measurement.
- 6.15 HEV America – Hybrid Electric Vehicle America Performance Test Program, the DOE sponsored test program for independently assessing the performance of vehicles submitted for testing.

## 7.0 References

- 7.1 ETA-HAC01 - "Control, Close-out and Storage of Documentation."
- 7.2 ETA-HAC02 - "Control of Test Conduct."
- 7.3 ETA-HAC04 - "Review of Test Results."
- 7.4 ETA-HAC05 - "Qualification, Certification & Training of Test Personnel."
- 7.5 ETA-HQA01 - “Audit of The Quality Assurance Program For The Control and Use of Measuring and Test Equipment”
- 7.6 ETA-HQP01 - “Quality Program”

- 7.7 Department of Defense (DOE) Order No. 5700.6C, “Quality Assurance,” dated 8-21-91
- 7.8 American Society of Mechanical Engineers (ASME)/NQA-1, “Quality Assurance Program Requirements for Nuclear Power Plants”
- 7.9 International Standard for Standardization (ISO) 9000, “Quality Management and Quality Assurance Standards - Guidelines for Selection and Use”

**APPENDIX-A  
Metrology Setup Sheet  
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Instrument/Device:	Calibration Due Date:	Initials / Date:
Fifth Wheel S/N:		
Fifth Wheel Calibrator S/N:		
DAQ S/N:		
DAQ 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:		
<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>

**APPENDIX-B  
Instrument Calibration List  
Annual/Semi-Annual Calibration  
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<b>Equipment Type:</b>	<b>Equipment Description</b>	<b>MFG:</b>	<b>Model No:</b>	<b>Serial No:</b>	<b>ETA No:</b>	<b>Status:</b>	<b>Cal Loc:</b>	<b>Last Cal:</b>	<b>Cal Due:</b>

**EXHIBIT-A  
Instrument Calibration Label  
(Sample)**

<p><i>Electric Transportation Applications</i></p> <p><b>Serial Number:</b> <b>ETA-0001</b></p> <p><b>CALIBRATION DUE DATE:</b> <b>00/00/04</b></p>
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