DMS EPO No. 52

Examination Procedure Outline for:

Electric Vehicle Fueling Systems (EVFS)

***The California Department of Food & Agriculture (CDFA) Division of Measurement Standards (DMS) recommends that this Examination Procedure Outline (EPO) be followed as the minimum criteria for examining commercial Retail Electric Vehicle Fueling Systems [EVFS, also known as Electric Vehicle Supply Equipment (EVSE)] and associated Timing Devices. Nonretroactive requirements are followed by the applicable date in parentheses.

Procedures that apply to corresponding requirements in multiple specific codes with similar paragraph designations are distinguished by that particular code section number followed by the appropriate paragraph designation. Requirements from the Electric Vehicle Fueling Systems (EVFS) Code are preceded by 3.40, requirements from the Timing Devices Code are preceded by 5.55, and the letter “G” applies to requirements from the General Code which are preceded by 1.10. General Code criteria apply to equipment that is designed to be used for the sale of electrical energy and time-related services.

Code section 5.55 applies when the EVFS is used in conjunction with other equipment in the EVFS to assess fees for time-based services such as parking in addition to those fees that are associated with the sale of electrical energy in units of the kilowatt-hour.***

NOTE:

Code references used throughout the document are drawn from National Institute of Standards and Technology (NIST) Handbook (HB) 44 General Code (Section 1.10), Electric Vehicle Fueling Systems Code (Section 3.40), and Timing Devices Code (Section 5.55) as adopted by Business and Professions Code (BPC) Section (§) 12107.

The relevant code section(s) is cited by its numerical designation and the applicable requirement(s) from that code section is identified by letter-number designation only.

California Code of Regulations, Title 4 (4 CCR), Division 9, Section 4000 references are identified by the code section and paragraph designation(s) from NIST HB 44 which are shown immediately after the corresponding line item or task listed in the procedure. For example, NIST HB 44 General Code (Section 1.10) is designated as “[1.10]:” followed by the paragraph designation(s) relevant to the line item.

California Code of Regulations, Title 4 (4 CCR), Division 9, Section 4002.11 references are identified by the section symbol “§” followed by the section number. For Example, 4 CCR Section 4002.11 is designated as “§ 4002.11” followed by the paragraph designation(s) relevant to the line item.

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Safety Notes.

Safety policies and regulations vary among jurisdictions. It is essential that inspectors and Registered Service Agents be aware of all safety regulations and policies in effect at the inspection site and practice their employer's safety policies. The safety reminders included in this EPO contain general guidelines useful in alerting inspectors and servicepersons of the importance in taking adequate precautions to avoid personal injury. These guidelines can only be effective in improving safety when coupled with training in hazard recognition and control.

The inspector is reminded of the importance of evaluating potential safety hazards prior to an inspection and taking adequate precautions to avoid personal injury or damage to the device. As a minimum, the following safety precautions should be noted and followed during the inspection:

- **Clothing**
- **Electrical Hazards**
- **Emergency Procedures**
- **Eye Protection**
- **Fire Extinguishers**
- **First Aid Kit**
- **Grounding**
- **Ignition Sources**
- **Lifting**
- **Location**
- **Nature of Product**
- **Obstructions**
- **Personal Protection Equipment**
- **Safety Cones/Warning Signs**
- **Traffic**
- **Transportation of Equipment**
- **Wet/Slick Conditions**

SAFETY REMINDER!!!

- Check the inspection site carefully for safety hazards and take appropriate precautions.
- Learn the nature of hazardous products at, or near, the inspection site.
- Know the emergency procedures and location and operation of fire extinguishers and emergency shut offs.
- Post safety cones/warning signs and be aware of vehicle and pedestrian traffic patterns.
- Use caution when moving in wet, slippery areas.
- If leaks, spills, or exposed wiring cause hazardous testing conditions, it is recommended that the testing be discontinued until the unsafe conditions are corrected.
- Use personal protective equipment appropriate for the inspection site.
- Be sure that a first aid kit is available and that the kit is appropriate for the type of inspection activity.
- Use correct connections appropriate for interface with the device under test.

ADDITIONAL SAFETY CONSIDERATIONS -

- Assess the overall safety condition of the EVFS.
- Report loose, exposed, frayed, or worn EVFS charge cables and damaged or worn connectors to the designated local responsible party.
- Avoid tests while standing on wet surfaces or in environments that expose the EVSE to damp or wet conditions.
- Ensure unobstructed access to the EVFS for the field examination process.
- Identify the EVFS’s power capacity, voltage, type of current, amperage, and system’s power transfer method, and verify compatibility with the test standard.
- For EVFSs equipped with an integral timing device, verify the timing test standard is appropriate.
- Verify that the method of activating the EVFS is available for conduct of the test.
- Do not leave an activated dispenser unattended!

Equipment List.

The following criteria should be considered when selecting equipment for the test:

1. Test Standard - Electric Vehicle Charging System Test Standard.
   Ensure the field standard is of a capacity and type of voltage matches that of the EVFS under test. In accordance with NIST HB 44, General Code paragraph G-N.3. Test Methods, the test methods for determining compliance to NIST HB 44 Sections 1.10 and 3.40, and, where applicable, Section 5.55 outlined in this document does not preclude the use of additional or other methods and apparatus approved by the Director as outlined in Appendix A. Fundamental Considerations Section 3. Testing Apparatus paragraph 3.2. Tolerances for Standards. The tolerances for the combined error and uncertainty of any standard used for testing must be less than one-third the applicable device tolerance. Measurements from the test standards must be metrologically traceable to the International System of Units (SI) through NIST or other National Measurement Institute signatory of International Committee of Weights and Measures (CIPM) Mutual Recognition Arrangement (MRA) for accuracy. A Type 2 (as defined in NIST HB 44 Appendix A-Fundamental Considerations, Section 3; Appendix D-Definitions) Transfer Standard is not recommended for use in testing EVFSs.

2. Test Standard - Field Standard Stopwatch or Interval Timer.
   The test standard used in the verification of the EVFS commercial time measuring element conforms to NIST HB 105-5 Specifications and Tolerances for Field Standard Stopwatches or another suitable designated standard. NIST HB 105-5 is available on the NIST Office of Weights and Measures (OWM) website at: www.nist.gov/pml/owm/nist-handbooks. In accordance with NIST HB 44, Fundamental Considerations Section 3 paragraph 3.2, the combined error and uncertainty of any standard used for testing must be less than one-third the applicable device tolerance.

   A timing device shall be tested with a timepiece with an error of not greater than plus or minus 15 seconds per 24-hour period. In the test of timing devices with a nominal capacity of 1 hour or less, stopwatches with a minimum division of not greater than one fifth second shall be used. In the test of timing devices with a nominal capacity of more than one hour, the value of the minimum division on the timepiece shall be not greater than one second. Time pieces and stopwatches shall be calibrated with standard time signals as described in NIST Special Publication 432 NIST Time and Frequency Services, or any superseding publication.

3. Additional Equipment.
   An activation card {e.g., credit card, cash value card, debit card, or other card used to activate the EVFS or other remote device [Radio Frequency Identification (RFID)], swipe card (processed without insertion into a reader), etc.} or software application (app) (e.g. iOS/android-based applications) to activate the EVFS for transactions. Near field communication (NFC) {e.g. apple pay, google pay, or other mobile payment or digital wallet payment} URL based activation {e.g. web-based address used for payment}.

   Man-in-the-middle cable for AC and/or DC testing when using a vehicle as a load.

   Programmable load emulator when performing AC and/or DC testing using a resistive load.

Definitions.

1. Control Pilot (CP) Signal.
   An electrical signal that is sourced by the Electric Vehicle Supply Equipment (EVSE). Control Pilot is the primary control conductor and is connected to the equipment ground through control circuitry on the vehicle and performs the following functions:

   a. Verifies that the vehicle is present and connected
   b. Permits energization/de-energization of the supply
   c. Transmits supply equipment current rating to the vehicle
   d. Monitors the presence of the equipment ground
   e. Establishes vehicle ventilation requirements

   [Source for this definition: SAE J1772-2024: Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler 3.8 Control Pilot]

2. Electricity as Vehicle Fuel.
   Electrical energy transferred to or stored onboard an electric vehicle primarily for the purpose of propulsion. [§ 4002.11. 3.40]

3. Interference test.
   A test intended to determine the operation of the measuring and indicating elements of an electric vehicle fueling system designed to assess time fees associated with the fees for the delivery of electrical energy to an electric vehicle automatically, accurately, clearly, and separately provide all required transaction information for the sale as set forth in NIST Handbook 44 Sections 3.40 and 5.55.

4. Maximum current deliverable (MCD).
   The maximum current that the EVSE can deliver as installed under optimum conditions. [NIST Handbook 44]

5. Maximum deliverable amperage (MDA).
   The maximum current available from the EVSE at the time of the test as determined by the Control Pilot Pulse Width Modulation signal or via digital communication between the EVSE and EV or test equipment. [NIST Handbook 44]

6. Proximity Pilot (PP) Signal.
   An electrical signal used for communication between the electric vehicle fueling system and electric vehicle to confirm the presence and proper connection prior to delivery of electrical energy.

7. Charging Status Levels.
   Six levels have been established in SAE J1772 based on the readiness of an electric vehicle when connected to and an electric vehicle fueling system for charging the vehicle's battery system; the protocols that identify the state of readiness for charging are:

   - State A represents Either Cable or EV not connected or standby
   - State B represents Cable connected to EV and the EVSE the vehicle is detected
   - State C represents ready for EV Charging
   - State D represents ready for EV Charging (Ventilation required)
   - State E represents Error conditions where there is no power
   - State F represents Fault conditions

Effective Dates.

Effective Date for AC EVSE. -- All AC EVSE used for commercial purposes shall comply with all requirements of this article in accordance with the following: **§ 4002.11 [3.40]: A.1.1**

(a) All AC EVSE installed prior to January 1, 2021, shall comply with the requirements of this article by January 1, 2031.*

(b) All AC EVSE installed on or after January 1, 2021, shall comply with the requirements of this article upon installation.

* See EPO No. 52 REF-A for further information.

Effective Dates for DC EVSE. -- All DC EVSE used for commercial purposes shall comply with all requirements of this article in accordance with the following: **§ 4002.11 [3.40]: A.1.2**

(a) All DC EVSE installed prior to January 1, 2023, shall comply with the requirements of this article by January 1, 2033.*

(b) All DC EVSE installed on or after January 1, 2023, shall comply with the requirements of this article upon installation.

* See EPO No. 52 REF-A for further information.

Type Evaluation.

The National Type Evaluation Program (NTEP) or California Type Evaluation Program (CTEP) will accept for type evaluation only those EVSEs that comply with all requirements of this article and have received safety certification by a nationally recognized testing laboratory (NRTL). **§ 4002.11 [3.40]: A.4**

Temperature Range for System Components

EVSEs shall be accurate and correct over the temperature range of - 40 °C to + 85 °C (- 40 °F to 185 °F). If the system or any measuring system components are not capable of meeting these requirements, the temperature range over which the system is capable shall be stated on the National Type Evaluation Program (NTEP) Certificate of Conformance (CC) or California Type Evaluation Program (CTEP) Certificate of Approval (COA), conspicuously, legibly, and indelibly marked on the EVSE, and installations shall be limited to the narrower temperature limits. **§ 4002.11 [3.40]: S.3.5**

1. Inspection

1.1. Accessibility and assistance in inspecting, testing, and sealing. **[1.10]: G-UR.2.3., G-UR.4.4.**

1.2. General Considerations.

1.2.1. Selection and Suitability. **[1.10]: G-S.3., G-UR.1.1., G UR.1.2.**

[3.40]: S.3.4.

System materials; design elements (to include computing capability, the details of its indicating and recording elements, and value of its smallest unit and unit prices); and construction must be suitable for the service and environment in which it is used. These elements must also ensure accuracy is maintained, parts function as intended, data storage and retrieval, and adjustments are reasonably permanent under conditions of normal use.

1.2.2. Installation. **[1.10]: G-S.2., G-UR.2.1., G UR.2.2.,**

[3.40]: S.4.2., UR.2.1., UR.2.2., UR.2.3.

The system and any associated equipment ensure the assembly, installation, and construction do not facilitate fraud.

A system shall be installed according to the manufacturer's instruction and when installed in a fixed location its operation and performance will not be adversely affected by the foundation, support structure, or any other details of the installation. The system shall not be installed in such a way that it will exceed the rated maximum current or voltage identified by the manufacturer.

A system is installed so that there is no obstruction between the primary indicating or recording element and the measuring element.

A system is installed so that any reversal of energy flow does not result in errors exceeding tolerance.

1.2.3. Position of Equipment. **[1.10]: G-UR.3.3.**

A device or system equipped with a primary indicating element and used in direct sales shall be positioned so that its indications may be accurately read and the measuring operation may be observed from some reasonable "customer" and "operator" position. The positioning shall be determined on a case-by-case basis, considering the

individual circumstances including the size and character of the indicating element

1.2.4. Use and Maintenance. **[1.10]: G-UR.3.1., G-UR.4.1., G-UR.4.2.**

The system and any associated equipment are to be operated and maintained as intended by the manufacturer. **[3.40]: UR.3.5.**

Unstable indications or other abnormal equipment performance observed during operation shall be corrected and, if necessary, brought to the attention of the firm.

1.2.5. Computing Capability. **[3.40]: UR.1.1.**

1.3. Indicating and Recording Elements.

1.3.1. Design. **[3.40]: S.1.1., S.1.2., S.1.2.1.**

Indicating and recording elements must be clear, definite, and easily read. The design shall be such that indications are clear and there is no interference between time measurements (when applicable) and electrical energy measurements. Multiple EVFSs may use a single indicating element that clearly and distinctly displays information for each individual EVFS.

1.3.2. Units.

1.3.2.1. Units – EVFSs. **[3.40.]: S.1.3.1.**

EVSE units used to charge electric vehicles shall be indicated and recorded in kilowatt-hours (kWh) and decimal subdivisions thereof. **§ 4002.11 [3.40]: S.1.3.2.**

The value of the smallest unit of indicated delivery by an EVSE, and recorded delivery if the EVSE is equipped to record, shall be no greater than 0.0005 MJ or 0.0001 kWh.

1.3.2.2. Units – Integral Time – Based Systems. **[5.55]: S.1.1.2., S.1.1.3.**

Integral time-based indications (where applicable).

1.3.3. Readability. **[1.10]: G-S.5., G-S.6. (1/1/77), G S.7., 3.40: S.1.3.3.**

Indicating and recording elements, operational controls must be adequately defined, clear, definite, and easily read. **[5.55]: S.2.**

1.3.4. Values of Intervals. **[1.10]: G-S.5.3., G-S.5.3.1.**

[3.40]: S.1.3.3.

Values of the graduated intervals must be uniform throughout the series of indicating elements or if equipped recording elements.

1.3.5. Indication of Delivery. **[3.40]: S.1.1., S.2.1.**

The EVSE shall automatically display on its face the initial zero condition and the quantity delivered (up to the capacity of the indicating elements). **§ 4002.11 [3.40]: S.2.7.**

1.3.6. In – Service Indicator Light (if applicable). **[5.55]: S.1.1.5.**

When so equipped, an in-service indicator light shall be operative only during the operation of the integral time feature of the EVFS.

1.3.7. Money – Value Divisions. **[3.40]: S.2.5.2.**

All money value divisions indicated on the primary and auxiliary indicating elements shall be identical.

1.3.8. Unit Price and Product Identity. **[3.40]: S.2.4.3., UR.1.1., UR.3.1.**

An EVSE shall be able to indicate on each face the unit price at which the EVSE is set to compute or to dispense at any point in time during a transaction. A computing EVSE shall display the unit price in whole cents (e.g., $0.12) or tenths of one cent (e.g., $0.119) on the basis of price per ~~megajoule (MJ) or~~ kilowatt-hour (kWh). In cases where the electrical energy is unlimited or free of charge, this fact shall be clearly indicated in place of the unit price. **§ 4002.11 [3.40]: S.2.4.1.** **[5.55]: UR.1.**

1.3.9. Multiple Unit Price Dispensers. **[1.10]: G-S.5.3.1.**

Capability for multiple unit pricing or time-based services over a single transaction shall indicate specified transaction information and appropriately identify the unit prices which are selectable by the customer. **[3.40]: S.1.1., S.1.2.1., S.2.4.3., UR.3.1., 5.55: UR.1.**

Statement of rates per units of time (where applicable) for time-based charges is clear and prominently displayed.

1.3.10. Advancement and Return to Zero. **[3.40]: S.2.1., S.2.2., UR.3.2., UR.3.5.**

Indicating and recording elements readily return to zero and it is not possible to return beyond the correct zero position. Zeroing operation is not possible during delivery. **[5.55]: S.1.1.4.**

Timing element advances only during operation of the device.

1.3.11. Recorded Representations

1.3.11.1. General. **[1.10]: G-S.5.6**

1.4. Provision for Sealing

[1.10]: G-S.8. (1/1/90)

[3.40]: S.3.3., Table S.3.3., 5.55: S.4.

Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or for physically applying a security seal in such a manner that the security seal must be broken before an adjustment or interchange can be made of:

- Any measuring or indicating element.
- Any adjustable element for controlling voltage and current when such controls tend to affect the accuracy of deliveries.
- Any adjustment mechanism that corrects or compensates for energy loss between the system and vehicle connection; and
- Any metrological parameter that will affect the metrological integrity of the EVFS.

1.4.1. Physical Means of Security. For Devices designed with a physical means of security, check for:

1.4.1.1. Accessibility of Adjusting Mechanism **[3.40]: S.3.3., 5.55: S.4.**

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal

1.4.1.2. Presence of Security Seals **[1.10]: G-UR.4.5.**

[3.40]: S.2.2., 5.55: S.4.

Check for the presence of security seals on the device. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Document missing seals on the official report and apply new seals as needed.

1.4.2. Audit Trails.

1.4.2.1. Audit Trails – Format **[1.10]: G-S.8. (1/1/90)**

For devices using an audit trail(s) as a means of security, the audit trail(s) shall use the format set forth in Table S.3.3. Categories of Devices and Methods of Sealing. **[3.40]: S.3.3., Table S.3.3.**

1.4.2.2. Audit Trail Information **[1.10]: G-S.8. (1/1/90)**

[3.40]: S.3.3., Table S.3.3.

If the system is equipped with an audit trail, note the event counter settings on the report form for future reference. If equipped with an event logger, print a copy of the event log and attach it to the report form for future reference. Note that on some systems an electronic copy of the event log may also be available. Examine these records for any signs of misuse of adjustments.

1.4.2.3. Event Logger **[3.40]: S.3.3., Table S.3.3.**

If security is provided using an event logger, the event logger shall include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter.

The event logger information shall be available at the time of inspection either as a printed copy or in electronic format. The information may be printed by the device, printed by another on-site device, or transmitted electronically.

The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1000 records are required. (Note: Does not require 1000 changes to be stored for each parameter.)

1.4.3. Adjustments Using Removable Digital Storage Devices. **[1.10]: G-S.8.2.**

[3.40]: S.3.3., Table S.3.3., 5.55: S.4.

For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device*, such as a secure digital (SD) card, USB flash drive, etc., security shall be provided for those parameters using either:

(1) an event logger in the device; or

(2) a physical seal that must be broken in order to remove the digital storage device

from the device (or system).

* This applies only to removable digital storage devices that must remain in the device or system for it to be operational.

1.4.4. Multiple Elements that Share a Common Provision for Sealing **[1.10]: G-S.8.1. (1/1/10)**

For multiple measuring elements with a single provision for sealing, a change to the adjustment of any measuring element must be individually identified.

1.4.5. Metrologically Significant Software Updates **[1.10]: G-S.9.**

A metrologically-significant software change is a sealable event.

1.4.6. Automatic Timeout, Pay-At-EVSE. **[3.40]: S.2.8. (1/1/20)**

After authorization, the device must de-authorize in two minutes if not activated. If the time limit to deauthorize the device is programmable, it shall not accept an entry greater than two minutes.

1.5. Markings

1.5.1. General Markings **[1.10]: G-S.1.**

1.5.1.1. Identification – General. **[1.10]: G-S.1.**

- Name or ID of manufacturer
- Model Designation
- Model Designation identifier and abbreviations **(1/1/03)**
- Nonrepetitive serial number **(1/1/68)**
- Serial number identifier and abbreviations **(1/1/86), (1/1/01)**

1.5.1.2. Identification – Software Version Markings **[1.10]: G-S.1.**

- Software version or revision identifier, software-based devices **(1/1/04)**

- Software version or revision identifier for not-built-for-purpose software-based devices. **(1/1/22)**
- Software version or revision identifier for all software-based devices. **(1/1/07)**
- Software version or revision identifier continuously displayed or accessible via the display. **(1/1/22)**

1.5.1.3. Other Markings

- National Type Evaluation Program (NTEP) Certificate of Conformance (CC) Number. **(1/1/03)**
- NTEP CC Number identifier. **(1/1/03)**

1.5.1.4. Device – Specific EVFS Additional Identification and Marking Information. **§ 4002.11 [3.40]: S.5.2.**

a. Voltage Rating

b. Maximum Current Deliverable (MCD)

c. Type(s) of current (AC or DC or, if capable of both, both shall be listed)

d. Minimum Measured Quantity (MMQ)

e. Temperature limits, if narrower than – 40 °F to 185 °F.

1.5.2. Location of Marking Information, Not-Built-For Purpose, Software-Based Devices. **[1.10]: G-S.1.1. (1/1/04)**

1.5.3. Visibility of required markings after installation. **[1.10]: G-UR.2.1.1.**

1.5.4. Location of Marking Information, Retail EVFS **[3.40]: S.5.1.**

1.5.5. Money-Operated Devices, Responsibility. **[1.10]: G-UR.3.4**

1.5.6. Limitation on Use **§ 4002.11 [3.40]: S.5.2.**

1.5.7. Equipment Capacity **§ 4002.11 [3.40]: S.2.4.2.**

An EVSE shall be able to conspicuously display on each face the maximum rate of energy transfer (i.e., maximum power) and the type of current associated with each unit price offered (e.g., 7 kW AC, 25 kW DC, etc.).

1.6. Measuring Elements.

1.6.1. Security Seals.

General	**[1.10]: G-S.8. (1/1/90), G S.9.** **[3.40]: S.3.3., Table S.3.3., 5.55: S.4.**
Security seal on adjusting mechanism -	**[1.10]: G-UR.4.5.**
Check for the presence of security seals on the device. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Document missing seals on the official report and apply new ones as needed.	**[3.40]: S.3.3., 5.55: S.4.**

1.7. Connection Cord.

Length and Protection	**[3.40]: UR.1.2.**

1.8. Facilitation of Fraud.

Facilitation of Fraud, General	**[1.10]: G-S.2**

1.9. Totalizers for EVFS Systems **[3.40]: S.7.**

2. Pretest Determinations.

2.1. Pretest Determination Notes.

Before testing the EVFS, verify the following.

1) The system is safe, legal, and suitable with respect to the installation for commercial use.

2) The jurisdiction permits the sale of electrical energy as a vehicle fuel.

3) If charges are also assessed for time related services, verify these additional fees are:
   (1) associated with an electric vehicle (EV) charging session;
   (2) calculated based on a recognized unit of time; and
   (3) separate from fees assessed for the sale of electricity that is based on a recognized unit of electrical energy.

4) If specific tariff rules apply, they are:
   - Properly interpereted,
   - Itemized in printed and/or electronically recorded representations and/or posted,
   - Accurately calculated, and
   - Where applicable, coordinated with other agencies that overlap as parking authorities.

2.2. Tolerances

2.2.1. Acceptance/Maintenance Tolerances	**[1.10]: G-T.1., G-T.2.**
2.2.2. Application	**[1.10]: G-T.3.** **[3.40]: T.1., T.4.** **[5.55]: T.1.**
2.2.3. Basic Values.	**§ 4002.11 [3.40]: T.2., Table T.2.** **[5.55]: T.1.3., Table T.1.3.**

Reference [1.10]: G-A.3.

2.2.4. Repeatability. **[3.40]: N.4., T.3.**

2.3. Digital Indications and Representations **[5.55]: T.2.**

To the tolerances that would otherwise be applied add an amount one-half the minimum value that can be indicated or recorded.

2.4. Statement of Rates. **[5.55]: UR.1.**

Where time fees are assessed in association with the electrical energy charging session the pricing for time rates are clearly, prominently, and conspicuously displayed.

2.5. Test Load. **[1.10]: G-A.3.**

[3.40]: N.3.1., N.3.3.

Identify the test site conditions under which testing will be conducted on an EVFS.

When conducting any tests on an EVFS, verify that the EVFS's power capacity, voltage, type of current, amperage, and system's power transfer method, and whether the system includes an integral timing device for testing is appropriate.

Determine the prescribed load can be met when an electric vehicle is used as the test load for a AC and/or DC system.

As a minimum, a "light load test," "midrange load test," and a "full load test" shall be conducted on an AC EVFS.
As a minimum, a "light load test," and a second test at a point between the "midrange load" up to but not exceeding a "full load" shall be conducted on a DC EVFS.

2.6. Test Draft Size Electrical Energy Test. **[1.10]: G-A.3.**

[3.40]: N.1., N.3.1., N.3.3.

Light Load tests, Midrange Load tests, Full Load tests and tests at other points shall be conducted at a quantity of at least the MMQ declared by the manufacturer.

3. Test Notes.

3.1. Totalizers — [3.40]: S.7

To determine proper operation of totalizers, read and record the totalizer indications before and after all test drafts. The system shall include this design feature for the quantity delivered for each device and this information shall be readily available on site or through on-site internet access.

3.2. Steps in the Test of an EVFS.

3.2.1. EVFS and Test Standard Connection Process.

a. Select the appropriate setup for the test standard; type of current and power transfer method and voltage based on the EVFS's fuel rating.

b. After connecting to the EVFS coupler, test procedures will be initiated using a laptop/table PC/standard, software, and load control/data acquisition (DAQ) hardware.

c. If applicable, connect the laptop/tablet PC to the DAQ system.

d. Utilize the authorization/activation method that has been identified to initiate the EV charging transaction session.

e. Determine the MDA from the control pilot (CP) signal or digital communication message communicated/signaled from the EVFS to the test standard. — **[3.40]: N.3.1., N.3.3.**

f. Verify, at the activation of the EVFS and at the start of the transaction measurements are continuously accumulating to display the quantity and total price for at least 15 seconds. — **[3.40]: S.1.2.**

g. Determine proper operation of totalizers, read and record the totalizer indications before and after all test drafts. — **[3.40]: S.7.**

3.2.2. After Each Test Load Delivery

a. Print a ticket if the device is so equipped and verify required information is provided on the receipt. — **[1.10]: G-S.5.6., G-S.5.6.1.**

Verify that appropriate abbreviations are used for indicated and recorded representation of units. — **[3.40]: S.2.6., UR.3.3., 5.55: S.1.4.1.**

Required recorded representation includes itemized timing charges when time services are assessed separately from charges for electrical energy as specified in Section 3.40. Electric Vehicle Fueling Systems paragraph S.2.6. EVSE Recorded Representations.

b. Verify that any options for obtaining a recorded representation are appropriate. The customer may be given the option of not receiving the recorded representation. **[1.10]: G-S.5.6.**

c. If the system is equipped with the capability, the customer may also be given the option of receiving the recorded representation electronically in lieu of or in addition to a hard copy. **[1.10]: G-S.5.6.** **[3.40]: S.2.6.**

d. Verify that required information is printed on the receipt for each transaction. **[3.40]: S.6., S.6.1.**

e. Duplicate receipts are permissible for timing devices, provided the word “duplicate” or “copy” is included on the receipt **[5.55]: S.1.4.1.1.**

f. Check price computations on all indicators (including consoles) and on recorded representations for mathematical agreement with its associated quantity representation or indication to the nearest 1 cent of money value. **[1.10]: G-S.5.5.** **[3.40]: S.2.5., S.2.5.1.**

g. Check for agreement of quantity, unit price, and total price values between indicated and recorded representations. **[1.10]: G-S.5.2.2.,** **[3.40]: S.2.4.4., S.2.5.2.**

h. Verify, after a delivery is completed, that the quantity and total price are displayed for at least 15 seconds. **[3.40]: S.1.2.**

3.3. Automatic Timeout, Pay-At-EVSE Retail Devices. **[3.40]: S.2.8. (1/1/2020)**

For Pay-At-EVSE retail devices, once the EVFS has been authorized, it must de-authorize within two minutes if the EVFS has not been activated.

To verify this operation

- First authorize the dispenser.
- Next, without dispensing product, wait two minutes and then attempt to dispense product.
- The system must not dispense product.

3.4. Confirm Results **[1.10]: G-S.5.4., [3.40]: N.3., N.4., T.3.**

If the result of any test is at, near, or exceeds the applicable tolerance limit, repeat that test to confirm the results and to help ensure you did not inadvertently introduce error into the test process. If necessary, conduct a "Repeatability Test" as described under the "Test" section of this EPO.

3.5. Display of Quantity and Total Price After Delivery. **[3.40]: S.1.2., S.1.2.1.**

Verify, after a delivery is completed, that the quantity and total price are displayed for a minimum of 15 seconds at the activation by the user and at the start and end of the transaction. Electrical energy sold shall be clearly identified and separated from other time-based fees indicated by the EVFS.

A system with a single indicating element for two or more EVFSs shall provide a means to indicate clearly which EVFS is associated with the displayed information.

3.6. Use of Adjustments. **[1.10]: G-UR.4.1., G-UR.4.2., G-UR.4.3.**

Verify that adjustments are used only to correct for conditions that these elements are designed to control and that adjustments are made to bring performance errors as close to zero value as possible. Verify that equipment is properly maintained and that errors are not predominantly in favor of the device user.

4. Tests

4.1. Accuracy Test **[1.10]: G-UR.3., [3.40]: UR.2. § 4002.11 [3.40]: S.5.2.**

For this and subsequent tests, verify that other conditions of use do not exceed marked or manufacturer- specified limitations.

The MDA available from the EVFS at the time of the test is determined by the CP pulse width modulation (PWM) signal or via digital communication between the EVFS and EV to the test standard equipment.

4.1.1. At the beginning of the first delivery, start with an initial zero condition. **[3.40]: S.2.1.**

4.1.2. If the result of the first test is at or near the tolerance limit, repeat this test. **[1.10]: G-S.5.4., [3.40]: N.4., T.3.**

4.1.3. Starting Load Test **§ 4002.11 [3.40.], N.2**

A system starting load test may be conducted by applying rated voltage and 0.5-ampere load.

4.1.4. Light Load Test.

(1) Connect the EVFS to the test set.
(2) Verify proper levels on the proximity pilot (PP) and CP lines.
(3) Based on the CP signal, determine the MDA from the EVFS.
(4) For AC EVFS set the test set load to a value at a point between 4 A and 10 A.
For DC EVFS set the test load to a point between 10 % and 20 % of the MDA, but not less than 30 A.
(5) Start energy measurement on the test set.
(6) Start a charging transaction on the EVFS.
(7) Cycle the CP from state A to state B to state C.
(8) Continue the measurement for an accumulated energy of not less than the MMQ as declared by the manufacturer.
(9) Cycle the CP from state C to state B to state A.
(10) Verify that the transaction on the EVFS has completed.
(11) Record the energy delivered as displayed on the EVFS.

(12) Record the price per kWh.

(13) Record the total price of the transaction.

(14) Record the energy delivered as displayed on the test set.

(15) *Verify Accuracy of Indications and Recorded Representations.* Verify the resulting energy indications and recorded representations are within applicable tolerances and meet requirements for agreement of indications. **[1.10]: G-S.5.2.2., [3.40]: S.2.4.4.**

(16) Calculate the energy measurement error as follows:

$$\% \, Energy \, Error = \frac{(Test \, Standard \, Indicated \, Energy - EVFS \, Indicated \, Energy)}{Test \, Standard \, Indicated \, Energy} \times 100$$

(17) Based on the unit price(s) [fixed or variable] per kWh, calculate and record the itemized and total computed price for the transaction.

(18) Calculate the total sales price as follows:

$$Sales \, Price \pm 1/2 \, cent =$$

$$(Quantity \, of \, Energy) \, (Energy \, Unit \, Price \, (\$/kWh))$$

(19) Agreement of Indications. Verify the energy sales price indications and recorded representations agree to within the nearest one cent of the mathematically computed money value and those money values agree with one another. **[1.10]: G-S.5.4., G-S.5.5.**

[3.40]: S.2.5.1., N.4., T.3.

If the result of the first test is at or near the tolerance limit, repeat this test. If necessary, conduct a Repeatability Test.

4.1.5. Midrange Load Test.

(1) Connect the EVFS to the test set.

(2) Verify proper levels on the PP and CP lines.

(3) Based on the CP signal, determine the MDA from the EVFS.

(4) For AC EVFS set the test load to a value at a point between 40 % and 60 % of the MDA.

(5) Start energy measurement on the test set.

(6) Start a charging transaction on the EVFS.

(7) Cycle the CP from state A to state B to state C.

(8) Continue the measurement for an accumulated

energy of not less than the MMQ as declared by the manufacturer.

(9) Cycle the CP from state C to state B to state A.

(10) Verify that the transaction on the EVFS has completed.

(11) Record the energy delivered as displayed on the EVFS.

(12) Record the price per kWh.

(13) Record the total price of the transaction.

(14) Record the energy delivered as displayed on the test set.

(15) *Verify Accuracy of Indications and Recorded Representations.* Verify the resulting energy indications and recorded representations are within applicable tolerances and meet requirements for agreement of indications. **[1.10]: G-S.5.2.2.** **[3.40]: S.2.4.4.**

(16) Calculate the energy measurement error as follows:

$$\%\ Energy\ Error = \frac{(Test\ Standard\ Indicated\ Energy - EVFS\ Indicated\ Energy)}{Test\ Standard\ Indicated\ Energy} \times 100$$

(17) Based on the unit price(s) [fixed or variable] per kWh, calculate and record the itemized and total computed price for the transaction.

(18) Calculate the total sales price as follows:

$$Sales\ Price \pm 1/2\ cent =$$

$$(Quantity\ of\ Energy)\ (Energy\ Unit\ Price\ (\$/kWh))$$

(19) Agreement of Indications. Verify the energy sales price indications and recorded representations agree to within the nearest one cent of the mathematically computed money value and those money values agree with one another. **[1.10]: G-S.5.4., G-S.5.5.** **[3.40]: S.2.5.1., N.4., T.3.**

If the result of the first test is at or near the tolerance limit, repeat this test. If necessary, conduct a Repeatability Test.

4.1.6. Full Load Test

(1) Connect the EVFS to the test set.

(2) Verify proper levels on the PP and CP lines.

(3) Based on the CP signal determine the MDA from the EVFS.

(4) For AC EVFS set the test set load to a value at a point between 70 % and 100 % of the MDA.

For DC EVFS set the test set load to a value at a point between 25 % and 100 % of the MDA. As a minimum this is the second point where a test shall be conducted on a DC EVFS and these two test points shall not be the same value and there shall be sufficient separation between the values of the two test points. When an EV is used as the test load for a DC system the load presented by the vehicle shall be greater than 40 % of the MDA and no less than 30 A.

(5) Start energy measurement on the test set.

(6) Start a charging transaction on the EVFS.

(7) Cycle the CP from state A to state B to state C.

(8) Continue the measurement for an accumulated energy of not less than the MMQ as declared by the manufacturer.

(9) Cycle the CP from state C to state B to state A.

(10) Verify that the transaction on the EVFS has completed.

(11) Record the energy delivered as displayed on the EVFS.

(12) Record the price per kWh.

(13) Record the total price of the transaction.

(14) Record the energy delivered as displayed on the test set.

(15) *Verify Accuracy of Indications and Recorded Representations.* Verify the resulting energy indications and recorded representations are within applicable tolerances and meet requirements for agreement of indications. **[1.10]: G-S.5.2.2. [3.40]: S.2.4.4.**

(16) Calculate the energy measurement error as follows:

$$\%\ Energy\ Error = \frac{(Test\ Standard\ Indicated\ Energy - EVFS\ Indicated\ Energy)}{Test\ Standard\ Indicated\ Energy} \times 100$$

(17) Based on the unit price(s) [fixed or variable] per kWh, calculate and record the itemized and total computed price for the transaction.

(18) Calculate the total sales price as follows:

$$Sales\ Price \pm 1/2\ cent =$$

$(Quantity\ of\ Energy)\ (Energy\ Unit\ Price\ (\$/kWh))$

(19) *Agreement of Indications.* Verify the energy sales price indications and recorded representations agree to within the nearest one cent of the mathematically computed money value and those money values agree with one another.

[1.10]: G-S.5.4., G-S.5.5.

[3.40]: S.2.5.1., N.4., T.3.

If the result of the first test is at or near the tolerance limit, repeat this test. If necessary, conduct a Repeatability Test.

4.1.7. Load Test Tolerances

§ 4002.11: [3.40] T.2

The tolerances for EVSE load tests shall be as shown in Table T.2. Accuracy Classes and Tolerances for EVSE.

Table T.2.

Accuracy Classes and Tolerances for EVSE

Accuracy Class	*Application or Commodity Being Measured*	*Acceptance Tolerance*	*Maintenance Tolerance*
2.0	AC electricity as a vehicle fuel	1.0 %	2.0 %
5.0[1]	DC electricity as a vehicle fuel	2.5 %	5.0 %
2.0[2]	DC electricity as a vehicle fuel	1.0 %	2.0 %

1. The tolerance values for Accuracy Class 5.0 DC EVSE are applicable to devices installed prior to January 1, 2033.
2. The tolerance values for Accuracy Class 2.0 DC EVSE are applicable to devices installed on or after January 1, 2033.

4.2. Time Test

[5.55]: N.1., N.2., T.1.3., Table T.1.3.

If the EVFS assesses charges for time-based services in addition to those charged for electrical energy, conduct a time test representative of a transaction where the EVFS is metering time.

- Establish the time interval for the test based on the rate structure applied by the EVFS.
- Initiate the EVFS in time mode and at the end of the time test interval record the time registration error.
- Determine if the rate calculations displayed and recorded representation (where applicable) are

mathematically correct.
If the result of this test is at, near, or exceeds the tolerance limit, repeat the test.

4.3. Interference Test **[5.55]: N.3., T.1.3.**

If EVFS assesses charges for time-based services in addition to those charged for electrical energy, conduct an interference test representative of a transaction where both the assessment of fees for the delivery of electrical energy and the time associated with that charging session are both metered through the EVFS.

Indicating and recording elements must be clear, definite, and easily read. The design shall be such that indications are clear and there is no interference between time measurements (when applicable) and electrical energy measurement during the simultaneous or separate registration of these charges during the transaction. **[5.55]: S.1.4.1., S.1.4.1.1., S.1.4.2.**

For an EVFS with an integral design feature where the device also has the capability to assess fees associated with the delivery of electrical energy to an EV which represent the registration of time that has elapsed simultaneously during the electrical energy charging session and/or immediately after that charging session, there shall be no interference in the registration or continuous indication between the electrical energy and time portion of the transaction. **[3.40]: UR.3.3.**
Verify the recorded values for both electrical energy and time are properly itemized and appropriately identified.

4.4. Repeatability Test **[3.40]: N.4., T.3.**

If necessary, conduct a repeatability test. A repeatability test must include at least three consecutive test loads. Test loads must be conducted under approximately the same conditions (e.g., energy rate and temperature) and be of approximately the same draft size and duration.

4.5. Money – Value Computations and Recroded Representation **[1.10]: G-S.5.5., [3.40]: S.2.5.1., S.2.4.3.**

4.5.1. Check money-value computations on for a sales transaction for a fixed price and selectable variable **[1.10]: G-S.5.2.2.**

pricing. Check that the computed price is mathematically correct.

4.5.2. Print a ticket if the device is so equipped and check price computations for agreement with the indication display.

4.6. RFI Test **[1.10]: G-N.2., G-UR.1.2., G-UR.3.2., G-UR.4.2.**

A system shall meet performance requirements when associated and non-associated equipment is operated in a customary manner and location. This testing is typically done during the inspection of a new installation. It is conducted subsequently only if a problem is suspected. This would include potential sources of interference such as, but not limited to: Radio Frequency Interference (RFI)

4.7. Zero-Set-Back Interlock. **[3.40]: S.2.1.**

4.7.1. Check the effectiveness of the zero-setback interlock. **[3.40]: S.2.2., S.3.4., S.2.3.2., S.2.3.3., 5.55: S.5.**

4.7.2. On equipment activated with a single remote controller, activate one EVFS and check all others operated by the same controller to make certain they will not operate without activating the individual EVFS starting mechanism.

4.8. Power Loss Test **[3.40]: S.2.3., S.2.3.1, S.2.3.2., S.2.6.**

4.8.1. At the time of the power loss, the transaction shall either: **[3.40]: S.2.3.3.**

(1) terminate; or

(2) continue without additional authorization after restoration of power if the EVFS is able to determine it is connected to the same vehicle before and after the power outage. In this case, the information needed to complete the transaction in progress at the time of the power loss shall be available at the EVFS, console, internet, or toll-free phone access. There must also be a clear indication on the receipt provided to the customer of the interruption, including:

- the date and time of the interruption.
- other information required by S.2.6. EVSE Recorded Representations.

4.8.2. The EVFS memory, or equipment on the network supporting the EVFS, shall retain information on the quantity of fuel dispensed and the sales price totals during power loss.

It is not typically necessary, nor is it recommended to repeat this test for every inspection; however, this does not preclude the test from being conducted when deemed necessary by the regulatory authority or service person to ensure continued compliance with this requirement. As a minimum, this test should be conducted on the examination of a system or device that is put into service for the first time to verify proper installation and set-up. It may also be warranted in response to specific complaints where the test would be relevant. It is recommended that, prior to conducting a test to verify compliance with these requirements, you check with your supervisor to verify your jurisdiction’s or organization’s policy regarding this test.

5. Post-Test Tasks

5.1. Secuity Means. **[1.10]: G-S.8. (1/1/90), G S.8.1. (1/1/10)** **[3.40]: S.3.3. Table S.3.3.** **[5.55]: S.4.**

5.1.1. Adequate provision shall be made for applying a physical security seal and/ or providing other approved means of security such as a data change audit trail. **[1.10]: G-S.8.2.** **[3.40]: S.3.3., 5.55: S.4.**

5.1.2. For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Devices. **[1.10]: G-S.8.1. (1/1/10)**

5.1.3. For multiple measuring elements with a single provision for sealing, a change to the adjustment of any measuring element must be individually identified.

5.1.4. A metrologically-significant software change is a sealable event. **[1.10]: G-S.9.**

5.1.4.1. Audit Trail Information. **[1.10]: G-S.8. (1/1/90)** **[3.40]: S.3.3, Table S.3.3., S.3.4.**

If the system is equipped with an audit trail, note the event counter settings on the test report form for future reference. If equipped with an event logger, print a copy of the event log and attach it to the report form for future reference. Note that some systems may be equipped to provide an electronic copy of the event counter or the event log in place of or in addition to providing a hard copy of the security information at the time of the inspection. This data shall not be affected or alterable. Examine these records for any signs of misuse of adjustments.

5.1.4.2. Security Seals. **[1.10]: G-UR.4.5.**

Check for the presence of security seals on the device. A security seal shall be affixed to any adjustment mechanism designed to be sealed. Document missing seals on the official report and apply new ones as needed.

5.2. Record Total Quantity. **[1.10]: G-UR.4.1., G-UR.4.2.**

[3.40]: S.7.

Note the final totalizer reading and record the total quantity of electricity dispensed and (where time- based fees are assessed in association with the electrical energy charging session service) the total time during the test on the official test report. Verify totalizers are working correctly.

5.3. Review/Analyze Results. **[1.10]: G-UR.4.1., G-UR.4.3.**

After all equipment at a location has been tested, review the results to determine compliance with requirements for equipment maintenance and use of adjustments.

5.4. Record Compliance Action and Explain Results.

Record the compliance action and disposition of the device on the report and explain the results to the device owner.

EPO No. 52 REF – A
(Est. 4/2025)

SUBJECT: CLARIFICATION REGARDING EFFECTIVE DATES, 4 CCR SECTION 4002.11

AC EVFS installed prior to January 1, 2021, and DC EVFS installed prior to January 1, 2023, should not be inspected or tested unless based upon information received, such as a written request as described in BPC Section 12503; until - for AC EVFS January 1, 2031, and for DC EVFS January 1, 2033. In these situations, specifications and tolerances cannot be applied, however counties may exercise applicable code sections including Business and Professions Code Section 12024.2 (a)(1) regarding charging an amount greater than the price, or computing an amount greater than a true extension of a price per unit, that is then advertised, posted, marked, displayed, or quoted for that commodity.

Should an AC EVFS installed prior to January 1, 2021, or a DC EVFS installed prior to January 1, 2023, be replaced, the newly installed EVFS is subject to all applicable laws and regulations.

Also see DMS Notice D-23-01.