DIRECT ACCESS STANDARDS FOR METERING AND METER DATA (DASMMD) IN CALIFORNIA

MARCH 1999

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Introduction

The Direct Access Standards for Metering and Meter Data (DASMMD) are applicable to all market participants involved in Direct Access, or the provision of Direct Access-related services, in California and specify the minimum standards for safety, accuracy, and reliability of:

- Meter Equipment
- Meter Communications
- Meter Data Management and Meter Reading
  - Including rules for validating, editing, and estimating meter usage data
- Meter Installation, Maintenance, Testing, and Calibration
  - Including classifications of meter workers

These standards were established by California Public Utilities Commission (CPUC) Decision 98-12-080 and are generally broad in scope in order to allow an open architecture approach to metering and meter data, expand technology choices, and provide opportunities for all market participants on an equal basis. In instances where the CPUC did not adopt permanent standards in D.97-12-080, the standards established by D.97-12-048 and D.98-05-044 are included herein as indicated. This DASMMD is referred to and incorporated by reference into the associated Direct Access tariffs.

Copies of the DASMMD and Rule 22/Rule 25 are available on the UDC's websites as follows:

UDC	Website	For additional information
SCE	www.sce-esp.com	800-203-4634
PG&E	www.pge.com	415-973-1666
SDG&E	www.sdge.com	619-654-8211

Copies of CPUC decisions are available upon request from the CPUC by calling 415-703-1282 or on the CPUC's website at: www.cpuc.ca.gov

For detailed information regarding ANSI standards, please consult the American National Standards Institute website at: www.ansi.org

The standards contained in the DASMMD are subject to change. As such, the UDC should be consulted in case of doubt regarding any particular standard. Nothing in the DASMMD is intended to modify the parties' rights and obligations under Rule 22/Rule 25. The provisions of the UDC's tariffs supersede any provisions contained in the DASMMD which may appear to be inconsistent or contrary.

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CHAPTER A

STANDARDS FOR METER PRODUCTS

Standards for Meter Products

I. TABLES OF STANDARDS

The following Tables provide a list of standards for meter products. Table I-1 lists standards which shall be requirements for meter products used in Direct Access.

Table I-1: Standards Required for Meter Products Used in Direct Access

Standards	Required in CPUC D.97-12-048	Effective date	Comments
ANSI C12.1-1995, Code for Electricity Metering	Yes	12-17-98	To be used in conjunction with Standards for Meter Products, Section II: Certification Testing Requirements.
ANSI C12.7-1993, Watt-hour Meter Socket	Yes	12-17-98	Applies only if a meter socket is being used.
ANSI C12.8-1981 (R1997), Test Blocks and Cabinets for Installation of Self-Contained A-Based Meters	Yes	12-17-98	Applies only if an A-base meter is used.
ANSI C12.9-1993, Test Switches for Transformer-rated Meters	Yes	12-17-98	
ANSI C12.10-1997, Electromechanical Watt-hour Meters	Yes	12-17-98	
ANSI C12.11-1987 (R1993), Instrument Transformers for Revenue Metering, 10 kV-350 kV BIL (0.6-69 kV NSV)	Yes	12-17-98	
ANSI C12.13-1991, Electronic TOU Registers for Electricity Meters	Yes	12-17-98	Applies only if the meter has a time-of-use register.
ANSI C12.20-1998, 0.2% & 0.5% Accuracy Class Meters (approved but not yet published)	Yes	3-18-2000	To be used in conjunction with Standards for Meter Products, Section II: Certification Testing Requirements.
ANSI C37.90.1-1989 (R1994), Surge Withstand Capability (SWC) Test	Yes	12-17-98	Adds to ANSI C12.1
ANSI 57.13-1978 (1987), C57.13.1-1981 (1992), C57.13.2-1991, C57.13.3-1983 (1991), Instrument Transformers	No	12-17-98	These accuracy and safety performance standards are used in conjunction with ANSI C12.11.

Standards for Meter Products

Table I-1: Standards Required for Meter Products Used in Direct Access (continued)

Standards	Required in CPUC D.97-12-048	Effective date	Comments
ANSI C12.18-1996, Protocol Specification for ANSI Type 2 Optical Port	No	6-1-99	Applies only if a Type 2 Optical Port is being used.
Applicable FCC Regulations	Yes	12-17-98	All meters and associated equipment are to meet all applicable FCC regulations
Certification Testing Requirements	Yes	4-16-99	Standards for Meter Product, Section II.
Submission of meter type self-certification documents to the Energy Division. Meter product manufacturer to make available all backup documentation that is related to the certification testing requirements for the meter type that is being certified.	Yes	4-16-99	Standards for Meter Product, Section III.
Stickers, sealing and locking hardware requirements.	Yes	4-16-99	Standards for Meter Product, Section VI.
Manufacturing date to be included on all new meter products.	Yes	4-16-99	Standards for Meter Product, Section V.
Procedures to follow when rebuilding, retrofitting, or repairing a meter product.	Yes	4-16-99	Standards for Meter Product, Section VI.
For meter products which store and provide interval meter data, the meter must be capable of providing and storing the interval meter data for a minimum of 35 days.	Yes	4-16-99	Standards for Meter Product, Section VI.

Standards for Meter Products

Table I-2 provides a summary list of tests in ANSI C12.1 and C12.20 Standards, a sunlight test, and ANSI C37.90.1 test. All shall be applied in conjunction with Section II: Certification Testing Requirements. This list also shows the eight tests required to be performed in series.

Table I-2: List of Tests in ANSI C12.1 and C12.20 Standards

Line No.	Tests performed in series (Sections II.1.6.,II.5.&II.6.)	Descriptions of Certification Tests	ANSI C12.1	ANSI C12.20
1		No Load	Test #1	Test #1
2		Starting Load	Test #2	Test #2
3		Load Performance	Test #3	Test #3
4		Effect of Variation of Power Factor	Test #4	Test #4
5		Effect of Variation of Voltage	Test #5	Test #5
6		Effect of Variation of Frequency	Test #6	Test #6
7		Equality of Current Circuits	Test #7	Test #7
8		Internal Meter Losses	Test #8	Test #8
9		Temperature Rise	Test #9	Test #9
10		Effect of Register Friction	Test #10	Test #10
11		Effect of Internal Heating	Test #11	Not applicable
12		Effect of Polyphase Loading	Not applicable	Test #11
13		Effect of Tilt	Test #12	Not applicable
14		Stability of Performance	Test #13	Not applicable
15		Independence of Elements	Test #14	Not applicable
16	✓	Insulation	Test #15	Test #12
17	✓	Voltage Interruptions	Test #16	Test #13
18	✓	Effect of High Voltage Line Surges	Test #17	Test #14
19		Effect of External Magnetic Field	Test #18	Test #15
20		Effect of Variation of Ambient Temperature	Test #19	Test #16
21		Effect of Temporary Overloads	Test #20	Test #17
22		Effect of Current Surges in Ground Conductors	Test #21	Test #18
23		Effect of Superimposed Signals	Test #22	Test #19
24		Effect of Voltage Variation-secondary Time Base	Test #23	Test #20
25		Effect of Variation of Amb. Temp.-second. Time Base	Test #24	Test #21
26	✓	Electrical Fast Transient/Burst	Test #25	Test #22
27		Effect of Radio Frequency Interference	Test #26	Test #23
28		Radio Frequency Conducted and Radiated Emission	Test #27	Test #24
29	✓	Effect of Electrostatic Discharge (ESD)	Test #28	Test #25
30		Effect of Storage Temperature	Test #29	Test #26
31	✓	Effect of Operating Temperature	Test #30	Test #27
32	✓	Effect of Relative Humidity	Test #31	Test #28
33		Mechanical Shock	Test #32	Test #29
34		Transportation Drop	Test #33	Test #30
35		Mechanical Vibration	Test #34	Test #31
36		Transportation Vibration	Test #35	Test #32
37		Weather Simulation	Test #36	Test #33
38		Salt-spray	Test #37	Test #34
39		Rain tightness	Test #38	Test #35
40		Test #A1: Sunlight Interference	Not yet included	Not yet included
41	✓	Test #A2: ANSI C37.90.1, Surge Withstand	Not yet included	Not yet included

II. CERTIFICATION TESTING REQUIREMENTS

This Section describes the certification testing requirements that Meter Products used in Direct Access metering must comply with. These tests are extracted and modified accordingly from the Meter and Data Communication Standards (MDCS) Workshop Report, Appendix A, filed with the California Public Utilities Commission on July 25, 1997 and the Joint Parties Letter, Appendix B, filed with the CPUC on November 24, 1997. This Section shall be used in conjunction with ANSI C12.1 and C12.20 Standards to cover issues that are not currently addressed in the ANSI C12.1 and C12.20 Standards. Some of these issues are: 1) duplication of the field electrical and environmental conditions is necessary to assure safety, 2) not all components of a meter product are required to be included in the meter product during certification testing, 3) reporting of certification tests is not based on all meter products tested, 4) no certification rejection criteria is provided for declaration of success or failure upon completion of certification tests.

II.1. General

II.1.1. The tests specified shall be conducted by qualified facilities. A qualified facility is a facility that has access to the necessary equipment and personnel to perform the testing requirements specified in this document.

II.1.2. Complete performance testing is required for new meter types and for major design changes to existing meter types. If an incremental change or changes are made to an existing meter type, applicable tests shall be performed to assure that Meter Products meet the certification testing requirements as stated in this section.

II.1.3. The manufacturer shall provide a certified test report documenting the tests and their results to the purchaser. The test report shall be signed by the appropriate manufacturer representative(s) and shall include appropriate charts, graphs, and data recorded during testing.

II.1.4. No Meter Products and metering equipment shall be installed before all tests, as outlined in this section, are conducted.

II.1.5. Meter Products selected for certification testing must be representative of production run Meter Products **and must meet all applicable FCC regulations.**

II.1.6. The following tests shall be conducted in sequence using the same Meter Products selected as specified in II.1.5 above: Insulation, Voltage Interruptions, Effect of High Voltage Line Surges, Effect of Fast Transient / Burst, Effect of Electrostatic Discharge (ESD), Effect of Operating Temperature, Effect of Relative Humidity, and ANSI C37.90.1 (Surge Withstand). Other tests required by ANSI C12.1 and C12.20 may be done either in parallel or in sequence with the same Meter Products or a separate group of Meter Products; however, with the understanding that the same Meter Products must be used for all test procedures within each ANSI-numbered or FCC-numbered test.

II.1.7. All test Meter Products shall be kept as a certification proof for one year after the conclusion of the testing. These test Meter Products shall be made available during this period to any purchaser for inspection, if requested.

II.1.8. Meter Products which fail during the test shall not be repaired or tested further, but can be analyzed to identify the cause of failure.

II.1.9. When the test Meter Products fail to meet these testing requirements and after any correction is made on the new test Meter Products, all tests shall be re-started with the new test Meter Products.

II.1.10. If requested by the purchaser, the manufacturer shall notify the purchaser of the certification test schedule for purchaser's test witnessing.

II.1.11. If more than a minimum number of Meter Products are certification tested, the test results shall be based on and reported for all Meter Products tested.

II.2. Meter Product Failure Definition

A Meter Product shall be designated as failed if any of the following events occur during or after any certification test:

II.2.1. Failure of the Meter Product to perform all functions as specified in a test procedure.

II.2.2. Failure of the Meter Product to meet the fundamental technical performance specifications as specified by the manufacturer. The fundamental performance must include safety, accuracy and reliability of the Meter Product, and any other functions included in the Meter Product.

II.2.3. Signs of physical damage as a result of a test procedure.

II.2.4. The occurrence of a loss of data or other unacceptable mode of operation for the Meter Product as a consequence of a test procedure.

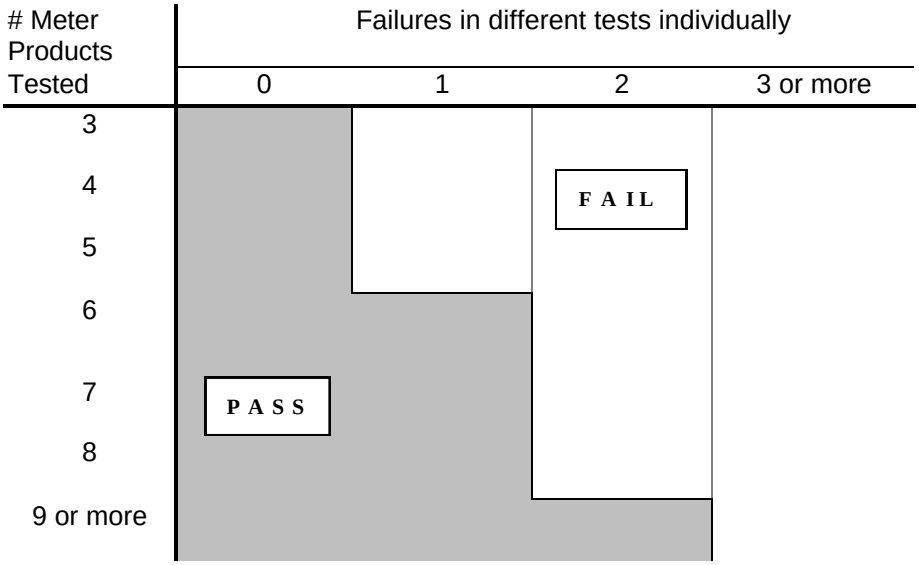
II.2.5. Failures of either hardware, firmware or software, or a combination thereof.

II.3. Meter Type Certification Rejection Criteria

The meter type certification will be rejected if any of the following events occur:

II.3.1. The Meter Products fail the certification tests as specified in Table II.3.1-a below:

Table II.3.1-a: Table of failures based on Meter Products tested



Examples: The following examples explain how to apply Table II.3.1-a. Also, reference to "the series tests" in this paragraph means tests required to be performed in the series manner as specified in Section II.1.6., and reference to "the parallel tests" means testing is not required to be performed in any particular sequence (either series or parallel).

Example 1: If 3 Meter Products are selected for the series testing and one failure occurs in any test procedure, the meter type certification will be rejected and the entire eight series tests will be started over from the beginning.

Example 2: If 9 Meter Products are selected for the series tests and the first, second, and third failures occur separately in three different tests or test procedures, the meter type certification will be rejected. These failures described here mean that a failure of the first Meter Product during one test procedure, a failure of a second Meter Product during another test procedure, and a failure of a third Meter Product during another test procedure different from the tests that the first two Meter Products have failed previously. Once such failures occur, the entire eight series tests will be started over from the beginning.

However, if 3 Meter Products are selected for a parallel test performed concurrently with the 9 Meter Products selected for the series tests, the rejection criteria for the 3 Meter Products tested in a parallel test shall not apply to the 9 Meter Products tested in series, or vice versa. In addition, if a group of Meter Products tested in a parallel test(s) fails according to the rejection criteria, only the particular failed test(s) needs to be repeated.

II.3.2. The failure of two or more Meter Products during the same test procedure.

II.4. Test Setup

II.4.1. The Meter Product shall be connected to its normal operating supply voltage with a fully charged power failure backup system and shall be energized throughout the duration of the test procedures, unless otherwise stated.

II.4.2. Before testing commences, if necessary, the Meter Product shall be energized for a reasonable period at room temperature for stress relief.

II.5. ANSI C12.1 Tests

All Meter Product certifications shall be performed in accordance with the certification tests described in ANSI C12.1 (NEMA, 1995), unless noted otherwise below.

* Tests 1 through 29:	no clarifications required.
* Test 30:	meter covers removed during test, temperature limits are defined for operations under California weather conditions as +85° C = T oper-max, -20° C = T stor-min
* Test 31 through 38:	no clarifications required
* Additional test A1:	sunlight interference test is needed for optical pick-up type retrofit modules (not within scope of existing ANSI C12.1-1995 tests) and is further defined below.
* Additional test A2:	ANSI C37.90.1 Surge Withstand Testing

The same set of selected Meter Products, as defined by unique meter numbers, will be tested with the following tests performed in series: 15, 16, 17, 25, 28, 30, 31 and A2. Other tests required by ANSI C12.1 may be done either in parallel or in sequence with the same Meter Products or a separate group of Meter Products; however, with the understanding, however, that the same Meter Products must be used for all test procedures within each ANSI-numbered or FCC-numbered test.

These ANSI C12.1 tests are listed and described in Table I-2 above.

II.6. ANSI C12.20 Tests

All Meter Product certifications shall be performed in accordance with the certification tests described in ANSI C12.20 (NEMA, 1998) for 0.2% and 0.5% accuracy class meters, unless noted otherwise below.

* Tests 1 through 26:	no clarifications required.
* Test 27:	meter covers removed during test, temperature limits are defined for operations under California weather conditions as +85° C = T oper-max, -20° C = t stor-min
* Test 28 through 35:	no clarifications required
* Additional test A1:	sunlight interference test is needed for optical pick-up type retrofit modules (not within scope of existing ANSI C12.20, NEMA-1998 tests) and is further defined below.
* Additional test A2:	ANSI C37.90.1 Surge Withstand Testing

The same set of selected Meter Products, as defined by unique meter numbers, will be tested with the following tests performed in series: 12, 13, 14, 22, 25, 27, 28 and A2. Other tests required by ANSI C12.20 may be done either in parallel or in sequence with the same Meter Products or a separate group of Meter Products; however, with the understanding that the same Meter Products must be used for all test procedures within each ANSI-numbered or FCC-numbered test.

These ANSI C12.20 tests are listed and described in Table I-2 above.

II.7. Test A1 - Sunlight Interference Test

A. This test verifies the Meter Product accuracy and full functional operations under direct sun light.
B. The meter cover shall be removed during this test.
C. The Meter Product shall be exposed to both the incandescent light source (Lab Test) and sunlight (Outdoor Sunlight Test).

Lab Test:

D. The incandescent light source, Smith Vector #710 or equivalent, shall be used to simulate the sunlight. The incandescent light shall be 600 watt and 3,200° K blackbody radiation as a minimum.
E. The Meter Product shall be exposed to the incandescent light source for a minimum of five minutes for each position of the incandescent light source.
F. The incandescent light source shall be pointed directly toward the Meter Product and positioned at a maximum direct distance of 19 inches from the center of the meter rotor shaft as follows:
  1. Twelve positions around the meter base.
  2. Eight positions at a 45° angle from the meter base.
  3. One position at a perpendicular to the face of the meter.
G. Verify the Meter Product operations and report the direct and remote meter reads before and after each incandescent light exposure.

Outdoor Sunlight Test:

H. The sunlight conditions shall be outdoors, clear sky, bright sunny day, and no shades over the Meter Product.
I. The Meter Product shall be exposed to sunlight conditions for 24 hours.
J. The Meter Product shall be set in a position as normally installed the field. All Meter Products under test shall be exposed to the sunlight conditions at the same time and evenly face different directions starting with one Meter Product facing towards the sunrise direction.
K. Record and compare direct and remote meter reads at every hour under the sunlight conditions.
L. To pass this test the Meter Product shall operate as specified with no observed anomalies and have an accuracy of ±0.3% on both direct and remote meter reads.

III. REGISTRATION AND CENTRALIZED DATABASE FOR DIRECT ACCESS COMPLIANT METER TYPE

Manufacturers must state that their meters meet the Certification Testing Requirements in Section II of Chapter A. The self-certification document shall be submitted to the Energy Division of the CPUC. During the review process, the staff of the Energy Division shall be entitled to obtain from the meter product manufacturer all backup documentation that is related to the certification testing requirements for the meter that the manufacturer is certifying. If the Energy Division determines that the self-certification document for a particular meter is in order, the Energy Division shall post the model number of the meter type, along with the name of the meter product manufacturer, on the Commission's web site. The document shall be verified by an officer or authorized employee of the manufacturer with the following statement:

DECLARATION

I, (print name and title) _____ hereby certify that I am empowered to act on behalf of _____ (manufacturer's name) and to submit this self-certification document on its behalf. I declare under penalty of perjury under the laws of the State of California that the above statements are true and correct, and that if any documents are furnished in connection with this self-certification document, that those documents are true and correct copies.

Dated _____, at _____.
(date) (place of execution)

Signature: _____

If the verification is made outside of California, the verification must be made by an affidavit sworn or affirmed before a notary public.

IV. REQUIREMENTS FOR STICKERS, SEALING AND LOCKING HARDWARE

Below are the requirements for the stickers, sealing and locking hardware used in Direct Access. **Requirements for application of these devices are covered in Chapter D: Standards for Meter Installation, Maintenance, Testing, and Calibration, Section II.1.**

IV.1. Sealing and locking hardware

Sealing and locking hardware shall be imprinted with company name and/or logo and be made with material other than lead. Sealing hardware owned by the MSPs shall be orange in color and be imprinted with its certification number.

IV.2. Life-support sealing hardware

Life-support sealing hardware used for identifying a customer premise which has a life support system shall be white in color and imprinted with a red caduceus (medical symbol).

IV.3. Life-support sticker

A life-support sticker used for identifying a customer premise which has a life support system shall be imprinted with a caduceus (medical symbol).

IV.4. 480 V sticker

A 480 V sticker used to identify a 480 Volt service panel and meter shall be legible.

V. REQUIREMENTS FOR LABELING MANUFACTURING DATE ON NEW METER PRODUCTS

New Meter Products shall be permanently labeled with a manufacturing date.

VI. REQUIREMENTS FOR REBUILT, RETROFIT AND REPAIRED METER PRODUCTS

VI.1. Rebuilt Meter Product

A Meter Product shall not be rebuilt and repackaged for resale by any entity except its original manufacturer or a manufacturer-authorized licensed agent. Once a Meter Product is rebuilt and repackaged, it shall be tested for accuracy, labeled as rebuilt and by whom, and dated accordingly.

VI.2. Retrofit Meter Product

A Meter Product may be retrofitted with other devices or modules. Retrofitted Meter Products shall be tested in accordance with the above Section II.1.2 of the Certification Testing Requirements. Prior to use, retrofitted Meter Products shall be tested for accuracy, labeled as retrofitted and by whom, and dated accordingly.

VI.3. Repaired Meter Product

A Meter Product shall not be repaired for resale by any entity except its original manufacturer or a manufacturer-authorized licensed agent. Once a Meter Product is repaired, it shall be labeled as repaired and by whom, and dated accordingly.

VI.4. Interval Data Meter Product

The meter or the meter data system must be capable of providing and storing required interval data for a minimum of 35 days.

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CHAPTER B

STANDARDS FOR METER COMMUNICATIONS

Standards for Meter Communications

I Meter Communication Standards

1. KYZ Contact Output

Meter products are not required to have a contact output. If a meter product has a contact output, it should be KYZ pulses per ANSI C12.1-1995 Standard (Code for Electricity Metering).

2. Meter Password Authorization

There are three types of password authorization:
1. Full read / write
2. Billing read / write (other routine maintenance exclusive of programming revenue quantities)
3. Read only

Because ESPs are responsible for safety, accuracy, and reliability of meters used in Direct Access, they shall have the authority to issue meter passwords at their discretion, but must issue read passwords to UDCs for audit purposes upon request. ESPs will provide meter passwords in a timely manner for UDCs to perform their scheduled functions.

3. Consumer Protection on KYZ Contact Output

For Direct Access customers who currently have their energy management systems utilizing KYZ outputs, they shall be notified by their ESP if a new meter used for Direct Access will not be compatible with their energy management systems.

4. Visual Meter Read

All Direct Access meters shall have a visual kWh display or a physical interface to enable on-site interrogation of all stored meter data. There are two reasons for requiring a visual meter display: (1) For consumer protection: The consumer can verify that the meter read matches the bill, and (2) For on-site interrogation when other meter communications systems fail: this would enable entities who are responsible for billing / settlements to obtain the meter read when investigating the communications failure. For electromechanical meters, the dials are sufficient for this on-site interrogation. At a minimum, electronic meters must have a physical interface to enable retrieval of all stored meter data.

If the meter has only a physical interface, the customer must be provided with the means to be able to retrieve the stored meter data in a way that can be understood. In addition, appropriate passwords would need to be issued to allow authorized customers, UDCs, and MDMAs to retrieve the stored meter data.

5. Optical Port Standard

If a Type 2 optical port is used, the port must meet ANSI C12.18.

CHAPTER C

STANDARDS FOR METER DATA MANAGEMENT AND METER READING

Standards for Meter Data Management and Meter Reading

I. DEFINITION OF MDMA BUSINESS FUNCTIONS[1]

The role of the MDMAs are to perform the following functions:

- Manage the meter reading schedule
- Read and retrieve meter data
- Validate, edit and estimate meter data
- Calculate usage
- Format data
- Store data on the MDMA server
- Manage data on the MDMA server
- Manage data access to the MDMA server.
- Meter / device management (i.e., when the meter / device was installed, what the device type is, what the service history has been, what the service parameters of the meter are, etc.)

The obligations of the MDMA are (Section H.(7) of Appendix A of D.97-10-087): "MDMA services will be performed in accordance with CPUC regulations and will be the responsibility of the party so indicated in the customer's DASR [direct access service request]. MDMA obligations include but are not limited to the following:

(a) Meter data for DA [direct access] Customers shall be read, validated, edited, and transferred pursuant to Commission-approved standards.
(b) Regardless of whether ESP or UDC perform MDMA services both UDC and ESP shall have access to the MDMA server.
(c) The MDMA shall provide Scheduling Coordinators (or their designated agents) reasonable and timely access to Meter Data as required to allow the proper performance of billing, settlement, scheduling, forecasting and other functions.
(d) The MDMA is required to keep the most recent 12 months of Customer consumption data for each DA Customer. Such data must be retained for a period of 36 months. Such data must be released on request to the customer or, if authorized by the customer, to any ESP or to the UDC.
(e) Within five days after installation of the meter, the MDMA must confirm that the meter and meter reading system is working properly and that the billing data gathered is valid.
(f) Either no more than 10 percent of the accounts will contain estimated data, or no more than 1 percent of all the data (e.g., the 720 hourly reads per month times the number of meters) will be estimated."[2]

In addition, to the above, the Commission also adopted the tariff provision that "The MDMA shall read interval meters on the utility's scheduled meter reading date, or on such other date as may be mutually determined by the MDMA and the utility."

[1] Definition of MDMA business functions is defined in CPUC D.97-12-048, pages 28-29.
[2] CPUC D.97-10-087 established limits on estimated data which was later modified by D.97-12-048, page 39.

II. MDMA QUALIFICATION TESTING[3]

Per CPUC D.97-12-048 UDCs and the ESPs are to adhere to the following before they or any of their subcontractors are permitted to offer any MDMA services:

(1) The existing regulated utilities who perform their own meter reading and meter data management shall be allowed to perform MDMA services for the UDCs, as well as for the ESPs. All utility employees who have successfully completed the utility's training programs regarding meter reading, and related safety programs, shall be permitted to carry out the meter reading activities required of an MDMA. All utility employees who have successfully completed the utility's training programs regarding meter data management (validation, editing, etc.) and entry shall be permitted to carry out the meter data management activities required of an MDMA.

(2) All non-utility entities and ESPs seeking to offer MDMA services shall be required to submit a written request to each UDC in whose service territory the ESP or entity seeks to offer such services. The written request shall include the following information: name of the person or entity; business address and telephone number; a description of the requesting party's experience in meter reading and meter data management; and a description of what educational and training requirements in meter reading, meter data management, and related electrical safety the MDMA will require of its employees before they are allowed to carry out the MDMA functions. The UDCs shall require the potential MDMAs to attach all pertinent training manuals and materials which describe the training in meter reading, safety, and meter data management that all of its employees have received or will undergo before the employee is allowed to perform MDMA-related activities. The request shall be verified.

(3) Upon receipt of the request, the UDC shall be required to review the written description and any attached materials, and to confirm in writing with the potential MDMA whether the proposed educational and training requirements are comparable with the UDC's requirements. If the UDC states that the proposed MDMA's educational and training requirements are not comparable, the person or entity may file a formal complaint with the Commission with regard to such qualifications. If the UDC states that the proposed MDMA's educational and training requirements are sufficient, then the MDMA may begin offering MDMA services so long as it meets all the MDMA-related requirements. The MSP is also free to require the MDMA to meet other requirements that are reasonably related to the MDMA's activities.

III. METER READING FREQUENCY

To ensure that the meter data is recorded, we will require the MDMAs to read the meters at least once a month. Such a requirement is also consistent with the timing of how often bills are to be rendered.

[3] The MDMA qualification process is defined in CPUC D.97-12-048, pages 40-41.

IV. MDMA SAFETY REQUIREMENTS

We will require in the direct access tariffs that all MDMAs comply with the pertinent electrical safety provisions of Cal OSHA and the UDC's safety requirements as they apply to the reading of electric meters. Prior to allowing an ESP, in its role as the MDMA, or a third-party MDMA, to perform meter reading, we will require the UDCs, as discussed below, to review the safety training and procedures that the MDMA and its employees are to follow. With regard to the recommendation that the MDMA report meter, safety, and hazardous conditions, and that site-specific information be kept, those safeguards are already contained in the direct access tariffs in Sections H(3) and H(8)(e).

V. MDMA TECHNICAL/BUSINESS SUPPORT TO ESPs AND UDCs

The MDMA will provide access to technical and business assistance during normal business hours (8am to 5pm Pacific time, Monday through Friday, except holidays). At such times, staff will be available to address question and concerns on data availability, corruption and adjustments, and systems technical support.

In addition, the MDMA will provide access to a support pager available 24 hours a day / 365 days a year to address issues of server availability. The MDMA shall respond and provide a status to all pages within 2 hours.

MDMA server availability or access issues will be dealt with as soon as reasonably possible. At the MDMA's discretion, concerns over data availability, data corruption and adjustments or non-urgent problems will be addressed during the next business day.

VI. MDMA PERFORMANCE STANDARDS

The following MDMA performance standards shall be applied:

- The first billing cycle shall be disregarded in performance standards
- Separate estimation of ISO data to server shall be done according to VEE rules in Attachment VEE (Section A for interval data and Section B for monthly data).

Timeliness For Validated Meter Reading Data[4]

The following standards shall be used to establish the time requirements for posting validated meter reading data on the MDMA server.

(a) Interval Meters:

(i) 80% of all usage data must be available on the first day after the scheduled reading date of the meter.

(ii) 90% of all usage data must be available within two days of the scheduled reading date of the meter.

(iii) 99% of all usage data must be available within five days of the scheduled reading date of the meter.

(b) Non-Interval (Monthly) Data:

(i) 85% of all monthly meter readings must be available by 6:00 a.m. on the 1st working day after the scheduled meter reading date.

(ii) 95% must be available by 6:00 a.m. on the 2nd working day after the scheduled meter reading date.

(iii) 99% must be available by 6:00 a.m. on the 5th working day after the scheduled meter reading date.

VII. MDMA PERFORMANCE EXEMPTIONS

In the event of a large catastrophe (i.e., hurricanes, earthquakes, etc.) that prevents the MDMA from reading meters, the MDMA shall estimate and post the data. This estimated data shall be reported separately by the MDMA in their performance report, and not be included in any performance penalties assessed against the MDMA.

In the event of meter failure where the meter is not accurately recording usage, the estimated data should be reported separately by the MDMA in its performance report, and would not be included in any performance penalties assessed against the MDMA, so long as the following conditions are met: (1) a manual reading has verified that the meter has failed and there is no problem with the remote reading technology; and (2) the exemption cannot occur for an account more than once in a 12 month period.

[4] The timeliness standards as defined in CPUC D.97-12-048, pages 31-32 and modified in D.98-12-080, pages 82-83.

VIII. EDI IMPLEMENTATION

The CPUC refrained from adopting permanent EDI standards until after the report and comments have been filed. The CPUC has directed the UDCs, ESPs, and MDMAs, to move toward using EDI to transfer meter usage information in accordance with the schedule described below:[5]

> We will adopt the recommendation which calls for all interested parties to work together to create a statewide implementation guide for the use of EDI. We will direct the Energy Division to ensure that this result is achieved through the Direct Access Tariff Review Committee established in D.97-10-087. We would like to implement the use of EDI on a trial basis no later than September 1, 1999, with the goal of having EDI as the only standard for transferring meter usage data no later than February 1, 2000. With this in mind, the Direct Access Tariff Review Committee needs to develop a proposed statewide implementation guide, and to file it no later than April 2, 1999. Comments to the report should also be permitted, and should be filed within 21 days of the report's filing. A Commission decision would then issue in June or July of 1999 to address the EDI standards and implementation guidelines. Under such a schedule, market participants can gear up to move toward an EDI format, with the expectation that a trial period will take place in the last four months of 1999 and in January of 2000, and that the MEP data format will be discontinued on February 1, 2000.

IX. VALIDATING, EDITING, AND ESTIMATION

The proposed implementation plan for changes to the interim interval rules is described in Table IX-1 below. The Optional/Required column indicates if market participants will be required to make this change. The Earliest date acceptable column indicates the earliest a market participant is allowed to implement this change (note to UDCs - this means the VEE test would need to allow these options), and the Required by column indicates the date by which market participants must implement the option (only applies to required options). MDMAs that were accepted prior to the required date must comply, but do not need to go through the acceptance process again.

During the discussion, it was noted that some of the optional changes have a bigger impact on some technologies than others.

[5] CPUC D.98-12-080, page 86.

Table IX-1: Implementation Plan for the Major Changes in Interval Data Rules

Modification	Optional/Required?	Earliest date acceptable	Required by
Spike check threshold	Optional	12-17-98	n/a
kVARh check threshold	Optional	12-17-98	n/a
Use of partial days for estimation	Optional (may make a bigger difference with some technologies than others)	12-17-98	n/a
Don't use days containing power failure as source for estimation	Required	12-17-98	90 days after Commission decision
Allow use of accurate meter readings scale estimated data	Optional (may apply more to some technologies than others)	12-17-98	n/a
Simplified proration algorithm when meter clock is off	Optional	12-17-98	n/a
Automated handling of irregular usage	Optional	12-17-98	n/a
Handling of test mode intervals	Required	12-17-98	90 days after Commission decision
Clarification of selection of reference days	Required	12-17-98	90 days after Commission decision
High/low usage check	Required	12-17-98	90 days after Commission decision
kVARh check	Optional	12-17-98	na

The Attachment on Validating, Editing, and Estimation (VEE) provides detailed requirements for energy usage data VEE rules for both monthly and interval customers as well as the ballot result on these VEE rules.

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CHAPTER D

STANDARDS FOR METER INSTALLATION, MAINTENANCE, TESTING, AND CALIBRATION

Standards for Meter Installation, Maintenance, Testing, and Calibration

I. MSP METER WORKER QUALIFICATIONS

All meter workers performing meter services for Direct Access must meet the requirements as outlined in this Chapter and exercise due care for the tasks performed. Out-of-socket meter accuracy testing, meter diagnostics, and sub-metering work[6] requirements are not addressed in these standards. Also, utilization of the meter's built-in diagnostics is not considered part of meter accuracy testing.

[6] Sub-metering work performed in California is presently covered by California Business and Professions Code Sections #12531 (Meaning and Scope of Terms) and 12532 (Engaging in Business as Device Repairman or Maintaining Device Repair Service Unlawful without Registration).

Standards for Meter Installation, Maintenance, Testing, and Calibration

I.1. Meter Worker Skill, Safety, and Qualification Requirements

The following are the descriptions and requirements of the five meter worker classes:

I.1.1. CLASS 1

I.1.1.1. Metering Types and Voltages

This class includes single-phase, socket-based meters, 300 V phase-to-phase maximum and does not include transformer rated meters. Communication wiring must be outside of energized meter panels.

I.1.1.2. Work to be Performed

Class 1 Meter Workers can install, remove, and replace single-phase, 120/240 V or 120/208 V, self-contained meters in standard socket based residential-type metering equipment. Connections of communication conductors must be outside the energized meter panels.

I.1.1.3. Essential Technical Skills

I.1.1.3.1. Understanding of single phase electrical metering.

I.1.1.3.2. Understanding of electric distribution safety procedures.

I.1.1.3.3. Ability to identify energy diversion or tampering related to this class of meter work.

I.1.1.3.4. Ability to install and remove damaged and undamaged meters.

I.1.1.3.5. Understanding of the meter panel and socket layout for the metering conditions related to this class of meter work.

I.1.1.3.6. Ability to read meters used in this class.

I.1.1.3.7. Ability to properly use tools appropriate to the work in this class.

I.1.1.3.8. Ability to connect meter communications external to the meter panel.

I.1.1.3.9. Ability to initialize meter communication modules - not utilizing Type 2 optical ports and meter configuration software.

I.1.1.4. Worker Safety and Safety Equipment

I.1.1.4.1. Job performance in accordance with employing MSP's procedures and safety rules.

I.1.1.4.2. Knowledge of hazards of electricity and ability to perform work to avoid electrical hazards.

I.1.1.4.3. Ability to comply with CAL OSHA requirements.

I.1.1.4.4. On-site use of personal protective equipment.

I.1.2. CLASS 2

I.1.2.1. Metering Types and Voltages

This class includes all meters and skills required for Class 1. Class 2 includes up to 600 V, single-phase and poly-phase, safety socket, and standard socket based meters, and does not include transformer rated meters. Communication wiring may be behind the panel, and work can be in and around energized circuits.

I.1.2.2. Work to be Performed

Class 2 Meter Workers can install, remove, and replace all meters consistent with the above. Class 2 Meter Workers must understand the operating characteristics of test-bypass facilities and test blocks, and may operate test-bypass facilities, but may not install, alter, maintain, or replace wiring between the meter and test block. On panels without test-bypass facilities, single-phase and poly-phase meters will not be removed or installed without first disconnecting the customer load or if deemed unsafe to do so under load. Communication wiring may be installed inside the panel, and work can be performed in and around energized circuits.

I.1.2.3. Essential Technical Skills

I.1.2.3.1. Cumulative including all skills for Class 1.

I.1.2.3.2. Additionally, possess skills related to meter voltages and meter forms used in Class 2.

I.1.2.3.3. Ability to perform phase rotation assessments.

I.1.2.3.4. Ability to operate test-bypass facilities or test blocks in a self-contained safety socket.

I.1.2.3.5. Ability to perform work required to route communication wiring to accommodate meter communications.

I.1.2.4. Worker Safety and Safety Equipment

I.1.2.4.1. Cumulative including all skills and safety knowledge for Class 1.

I.1.2.4.2. Electrical safety knowledge and work skills appropriate for single-phase and three-phase metering up to 600 V phase-to-phase, including the ability to identify and refer to a Class 5 meter installer services above 600 V phase-to-phase prior to performing work in the service equipment.

I.1.3. CLASS 3

I.1.3.1. Metering Types and Voltages

This class includes all meter types in Classes 1 and 2. Class 3 work includes up to 600 V, A base, K base, and transformer rated meters with internal diagnostics. Communication wiring may be behind the panel, and work can be in and around energized circuits.

I.1.3.2. Work to be Performed

In addition to Class 1 and 2 Meter Work, Class 3 Meter Workers can install, remove, and replace all meters consistent with the above including transformer-rated meters with internal diagnostics. Class 3 Meter Workers may operate test switches, but may not install, alter, maintain, or replace wiring between the meter, test switch, test block, and associated equipment.

I.1.3.3. Essential Technical Skills

I.1.3.3.1. Cumulative of Classes 1 and 2.

I.1.3.3.2. Additionally, possess skills related to meter voltages and meter forms used in Class 3.

I.1.3.3.3. Ability to understand the operating characteristics of metering transformers and how to operate test switches.

I.1.3.3.4. Ability to understand, interpret, identify, and take appropriate actions based upon built-in diagnostics of solid state meters.

I.1.3.4. Worker Safety and Safety Equipment

I.1.3.4.1. Cumulative of all safety skills for Classes 1 and 2.

I.1.3.4.2. Ability to understand, interpret, and take appropriate action based on built in diagnostics of solid state meters.

I.1.3.4.3. Ability to work with transformer rated meters and operate test switches and test blocks.

I.1.4. CLASS 4(A)

I.1.4.1. Metering Types and Voltages

This class includes all meter types in Classes 1, 2, and 3.

I.1.4.2. Work to be Performed

In addition to Class 1, 2, and 3 Meter Work, Class 4(A) Meter Workers can install, remove, and replace all meters consistent with the above. May perform in-field meter accuracy tests, calibrations, and perform all types of meter maintenance and troubleshooting on single phase meters up to 300 V. Programs and verifies internal programs and software in solid state meters.

I.1.4.3. Essential Technical Skills

I.1.4.3.1. Cumulative of Classes 1, 2, and 3.

I.1.4.3.2. Ability to perform work on metering switchboards.

I.1.4.3.3. Ability to perform calibration, repair, retrofit, troubleshooting, data collection of electric meters within the Class, and install, maintain, and program advanced metering technologies, including TOU, interval data, real time pricing, remote meter communication, and load control devices.

I.1.4.4. Worker Safety and Safety Equipment

I.1.4.4.1. Cumulative of all safety skills for Classes 1, 2, and 3.

I.1.4.4.2. Ability to conform processes to additional electricity hazards and complexities associated with metering switchboards, testing meters, and maintaining meters in service equipment up to 300 V.

I.1.5. CLASS 4(B)

I.1.5.1. Metering Types and Voltages

This class includes all meter types in Classes 1, 2, 3, and Class 4(A). Class 4(B) work includes all metering up to 600 V, including transformer rated meters with primary and secondary voltages less than 600 V. Communication wiring may be behind the panel, and work can be in and around energized circuits.

I.1.5.2. Work to be Performed

In addition to Class 1, 2, 3, and 4(A) Meter Work, Class 4(B) Meter Workers can install, remove, and replace all meters consistent with the above. May perform in-field meter accuracy tests, calibrations, and perform all types of meter maintenance and troubleshooting on all meters. Programs and verifies internal programs and software in solid state meters.

I.1.5.3. Essential Technical Skills

I.1.5.3.1. Cumulative of Classes 1, 2, 3, and 4(A).

I.1.5.3.2. Ability to perform work on metering switchboards.

I.1.5.3.3. Ability to perform calibration, repair, retrofit, troubleshooting, data collection of electric meters, and install, maintain, and program advanced metering technologies, including TOU, interval data, real time pricing, remote meter communication, and load control devices.

I.1.5.4. Worker Safety and Safety Equipment

I.1.5.4.1. Cumulative of all safety skills for Classes 1, 2, 3, and 4(A).

I.1.5.4.2. Ability to conform processes to additional electricity hazards and complexities associated with metering switchboards, testing meters, and maintaining meters in service equipment up to 600 V.

I.1.6. CLASS 5

I.1.6.1. Metering Types and Voltages

This class includes all meter types in Classes 1, 2, 3, 4(A), and 4(B). Class 5 meter work includes all metering above 600 V, including metering transformers, associated devices such as isolation relays and switches, and wiring between these transformers, associated devices, and meters. Communication wiring may be behind the panel, and work can be in and around energized circuits.

I.1.6.2. Work to be Performed

In addition to Class 1, 2, 3, 4(A), and 4(B) meter work, Class 5 Meter Workers can install, remove, and replace all meters consistent with the above including transformer-rated meters. Replace high-voltage fuses. Perform in-field meter accuracy tests, calibrations, and perform all types of meter maintenance and troubleshooting on all meters. Inspect wiring and instrument transformer ratios utilizing various apparatus as necessary.

I.1.6.3. Essential Technical Skills

I.1.6.3.1. Cumulative of Classes 1, 2, 3,4(A), and 4(B).

I.1.6.3.2. Ability to identify primary metering equipment and characteristics of service equipment rated at voltages above 600 V.

I.1.6.3.3. Broad knowledge and familiarity of electrical distribution systems above 600 V and operating characteristics.

I.1.6.3.4. Ability to identify UDC service voltages and electrical service requirements.

I.1.6.3.5. Broad knowledge and familiarity of State of California General Orders.

I.1.6.4. Worker Safety and Safety Equipment

I.1.6.4.1. Cumulative of all safety skills for Classes 1, 2, 3, 4(A), and 4(B).

I.1.6.4.2. Ability to conform processes to additional electricity hazards and complexities associated with metering switchboards, testing meters, and maintaining meters in service equipment above 600 V.

I.1.6.4.3. Meet the State of California requirements for a "Qualified Electrical Worker" to perform work on metering systems with instrument transformer at voltages above 600 V.

I.1.6.4.4. Must have a minimum of two years of combined training and experience with high-voltage (above 600 V) equipment and circuits.

I.2. CERTIFICATION OF METER SERVICE PROVIDER (MSP)

The following excerpt from D.97-12-048, as modified by 98-05-044 and D.98-12-080 is the MSP certification process that all UDCs, ESPs, and MSPs must adhere to:

(1) The existing regulated utilities who perform their own electric meter installation and removal, and meter maintenance and repair, shall be given permanent MSP certification. All utility employees who have successfully completed the utility's training programs regarding meter installation and removal, meter maintenance and repair, and related electrical safety programs, shall be permitted to install, remove, maintain and repair Direct Access meters on behalf of the UDC acting as an MSP.

(2) All non-utility MSPs shall be required to submit a written application to the Commission requesting "MSP Certification." The MSP Certification will be granted to persons or entities who possess a general electrical contractor's license issued by the Contractors' State License Board. If the ESP is acting as the MSP, then the contractor's license shall be in the name of the ESP.[7] The ESP may also subcontract the meter services to a third party, in which case the third party would be required to have a general electrical contractor's license.

The non-utility MSP is required to have an electrical contractor's license because the installation, removal or repair of an electric meter by a person other than a public utility is subject to the Contractors' State License Law. Generally speaking, a contractor is anyone who adds materials to, repairs, or subtracts materials from a structure or premises. (Bus. & Prof. Code Section 7026.) A regulated public utility is exempt from the Contractors' State License Law when it performs work on its own property, or when the work is undertaken in furtherance of the distribution of electricity. (Bus. & Prof. Code Section 7042.1.) Thus, anyone else installing, repairing, or removing an electric meter would be required to have a contractor's license as dictated by the current statutory provisions in the Business and Professions Code. An electrical contractor's license is appropriate because of the electrical voltage that is present.

The written application shall include the following information: name of the person or entity; business address and telephone number; the name of the person or entity in which the general electrical contractor's license is issued; the license number and expiration date; a

[7] If the ESP is a partnership, corporation, or limited liability company, the ESP shall designate a "responsible managing employee" to take the license examination on the ESP's behalf. (See Bus. & Prof. Code Section 7065.) A responsible managing employee shall mean an individual who is a bona fide employee of the ESP, and who is actively engaged in electrical contracting work.

description of the applicant's electric meter installation, maintenance, repair and removal experience, as well as the applicant's training and experience regarding electrical safety; and a description of what educational and training requirements in electrical work and electrical safety the MSP will require of its employees before they are allowed to install, maintain, repair or remove electric meters or metering devices. A copy of the general electrical contractor's license shall be attached to the application. The application shall be verified, and if verified outside California, the verification must be made by an affidavit sworn or affirmed before a notary public.

In addition to the written application, the MSP shall either arrange for a bond in favor of the State of California in the amount of $100,000 or provide the Energy Division with proof that the MSP has general liability insurance that meets the specifications described below.

If a bond is used, it shall be submitted with the written application. The bond shall be for the benefit of anyone who may be damaged as a result of the MSP's actions in connection with the installation, maintenance, repair, or removal of the electric meter. Should a complaint for damages arising from the MSP's actions be filed in civil court, and a claim is made against the bond, a copy of the complaint shall be served by registered or certified mail upon the Commission's Executive Director.

The bond requirement will ensure that the MSPs adhere to all applicable provisions governing the installation and removal of electric meters. Should an end-use customer suffer damages as a result of the MSP's actions, the bond will provide a source of compensation.

If the MSP elects to provide proof of liability insurance, the insurance shall meet the following specifications: (1) the insurance policy shall be commercial general liability insurance with coverage that, at a minimum, is the same as what is provided for in the Insurance Services Office Commercial Liability Coverage occurrence form; (2) the policy limit shall not be less than $1 million for each occurrence for bodily injury, property damage and personal injury, and if the coverage is subject to a general aggregate limit, the aggregate limit shall not be less than $2 million; (3) the policy shall include, as an additional insured, the UDC in whose service territory the MSP is operating in and the ESP for whom the MSP is performing the meter-related work; and (4) the liability insurance policy shall include a statement that thirty days' written notice shall be provided to the Commission, the ESP and the UDC before the policy is canceled. Proof of liability insurance will ensure that the MSP has sufficient coverage to cover any claims that might be brought against the MSP for metering-related activities.

The application shall be submitted to the following: CPUC, MSP Certification Unit, 505 Van Ness Avenue, San Francisco, CA 94102.

(3) Upon receipt of the application for MSP certification and the bond, the staff shall review the documents for compliance with this process. If the documents are in order, the staff shall issue a MSP certification number to the MSP. Upon the MSP's receipt of the MSP certification number, the MSP may offer meter installation related services to the ESPs or to the UDCs. By providing such services, the MSP agrees to abide by all Commission decisions, policies, and guidelines governing the installation, maintenance, repair and removal of electric meters. Should it be determined that the MSP is not in compliance with such requirements, the Commission may suspend the MSP certification.

(4) After receiving its MSP certification number, each MSP shall be required to submit a detailed work schedule to each UDC for the first 20 installations by a new MSP in that UDC's service area. In order to ensure that the UDCs have adequate information to make an informed assessment as to whether or not it should attend any of the 20 installations, the MSP is required to submit a detailed work schedule to describe the meter type that is being removed and installed, a description of all the procedures it will follow for removing and installing the meter, and what safety precautions will be taken during these procedures. The UDCs shall reserve the right to attend any of these installations.

(5) The application for MSP certification and requirements can be found at the CPUC Energy Division's website.

Should the UDC question the ability of an MSP to work on a particular meter type, the burden will be on the ESP to prove to the UDC that the MSP that it is using is qualified to work on that particular meter type. If the removal or installation involves skills in a higher meter class, the ESP may need to prove to the UDC that the MSP it is using possesses the necessary skill and experience for removing and installing a particular kind of meter.

II. METER INSTALLATION AND REMOVAL

This section proposes the minimum requirements for installation, maintenance, and testing for meters and metering equipment used in Direct Access. CPUC D.98-12-080 reaffirms the statement in D.97-10-087, Appendix A: Direct Access Tariff, Section H(1)(b) that:
"Potential and current transformers shall be considered part of the distribution system and shall remain the responsibility of the UDC."

Accordingly, and pursuant to D.97-10-087 and D.98-12-080, all instrument transformers, test switches, and associated wiring up to the meter socket shall remain the responsibility of the UDCs. However, per D.98-12-080, reconnecting existing wires to a replacement of an existing meter socket, A-base socket adapter, or A-base meter may be performed by either UDCs or MSPs.

II.1. Safety (customer life support, public, etc.)

For safety reasons, the following requirements must be completed prior to performing any meter work on site and visual observations must continually apply as the meter work progresses. Meter work includes, but is not limited to, meter installation, meter replacement, maintenance, programming, and testing. Visually inspect all meter sites for the following conditions:

II.1.1. Customer Life Support

II.1.1.1. If a customer premise has a life support device or equipment and a UDC requires life-support seals or stickers, they shall be installed on the meter ring or cover respectively, to prevent avoidable service interruption during the process of metering work.

II.1.1.2. If such life-support or sealing hardware is found on customer meter covers, meter panels, test switches and/or metering transformer panel sections, meter workers shall be cautious in performing meter work and not interrupting electric service to the customer premise. If service will be unavoidably interrupted for any meter work, the meter worker shall notify the customer and obtain the customer's consent prior to performing work.

II.1.2. Electrical Hazards

II.1.2.1. Various Hazardous Conditions

The hazardous condition may include exposed wiring, damaged sockets (loose or burnt wiring or jaws), auto-bypass devices (load jaws still hot when meter removed), loose or missing screws (i.e., in bypass area), missing panels, loose or broken service insulators, service wires in bad condition/order, missing meter, improper grounding conditions, fused neutral conductor of a 2 wire or 3 wire

single phase service, defective service switch / disconnect, new installations which fail to conform with the UDC's electric service requirements, etc.

II.1.2.2. 600 Volt Auto Valve (aka Lightning Arrestor or Surge Protector)

II.1.2.2.1. Auto valves are also called meter protectors or transformer surge arrestors and may be found on 480 V overhead meter installations, both self-contained and transformer-rated. Functional in the field, the auto valve may be safely removed from the meter installation. If MSP meter workers find that these valves cannot be safely removed, they must notify UDCs to schedule for removals.

II.1.2.2.2. The auto valve can be identified as a round or square metal can the size of a large human fist. The auto valve is mounted through a knock out and secured with a nut on the inside of the can. There will be 3 black wires and 1 white wire. The 3 black wires are electrically connected to each of the 3 phase wires on the service. The white wire is connected to an earth ground. The auto valve is attached to the socket side of the test block or test switches. By de-energizing the socket, the wires from the auto valve can be removed. Ensure that the hole left in the service equipment is properly closed and sealed for weather.

II.1.2.2.3. At MSP's discretion, an MSP may remove and discard the auto valve.

II.1.2.3. 480 V Sticker

If the meter does not display voltage, the Meter Worker shall ensure that a 480 V sticker is in place either on the meter or on the meter panel near the meter before leaving the site.

II.1.3. Physical Hazards

II.1.3.1. Tripping hazards (slippery or uneven surfaces), debris, or materials stored in the working space, overhead hazards (stored materials or workers above meters), etc.

II.1.3.2. Environmental hazards: Chemical, caustic, hearing, biological, etc.

II.1.3.3. Inadequate or unsafe access.

II.1.3.4. Meter Mounting: loose meter mounting, undue vibration, inability to securely seal metering, unleveled meter, etc .

II.1.4. Customer Premises

Unsafe conditions of customer-owned stairs, railings, platforms, etc.

II.1.5. Vermin

Watch out for insects, snakes, and rodents when opening doors or removing panels.

II.2. Meter Security and Accessibility

The following requirements must be completed when performing any meter work on site and visual observations must continually apply as the meter work progresses. Visually inspect all meter sites for the following conditions:

II.2.1. Infraction and Evidence of Tampering/Energy Diversion

II.2.1.1. Meter Installation

II.2.1.1.1. Awareness of significant connected loads compared to a customer's monthly energy consumption.

II.2.1.1.2. Irregularities in the service conductor's insulation ("skinned" insulation, newly-taped sections of conductors, burned or pitted service conductors, etc.)

II.2.1.1.3. Unauthorized connection in overhead service entrance, on line side of meter or metering transformers, or in unsealed underground pull sections or pull cans.

II.2.1.1.4. Unauthorized seals, and unsealed or improperly sealed conditions on line side raceways, test block compartments, test switch covers, and meter sealing rings.

II.2.1.1.5. Suspicious wiring.

II.2.1.1.6. Jumpers across current leads at bottom of test switch unsealed.

II.2.1.1.7. Meter coil jumpered - Check and correct if the neutral service wire is found connected through the series coil of the meter and there are grounds on the load circuits that act as a jumper.

II.2.1.1.8. Lock fuse jumpered - Check for lock fuse jumper and perform a regular meter test. Jumper will be left as found, and this condition will be reported on the test report.

II.2.1.1.9. Blown (or loosened) fuse in one leg of a 3-wire old sequence service.

II.2.1.1.10. Rate infractions in meter program / register.

II.2.1.2. Meter Cover

An unusually clean cover, small holes in the cover, burn marks on or near the cover, visible fingerprints inside the cover, etc.

II.2.1.3. KWH Register

KWH dial pointer alignment, register mesh, and register gears.

II.2.1.4. Meter Disk

Disk alignment to magnets, irregularity of disk rotation, foreign objects or materials on disk / bearing, scratches or wear marks on the disk, etc.

II.2.1.5. Test Blocks

Damaged wiring between test block and meter, unusual marks, scratches or burns on test blocks, defective test blocks, etc.

II.2.1.6. Meter Base

Unusual marks and mushroomed screw slots on potential links; broken meter seals; unusual wear or scratches, burn or pit marks on meter stabs / blades / terminals, etc.

II.2.1.7. Meter Socket

Unusual wear or scratches, burnt or pit marks, irregular meter socket voltages, circuit bypass jumper, etc.

II.2.1.8. Hidden "Service Riser" Taps and Un-metered Circuits Utilizing Relay Devices

Unusual noises that could indicate a relay opening when the meter is removed from the socket.

II.2.2. Meter Security

The following are the requirements for securing physical meters, panels, programmable meters, and data

II.2.2.1. Physical Meters and Panels

Meters and meter panels shall be secured with seals and locking devices as described in Chapter A, Standards for Meter Products, Section IV.

II.2.2.2. Programmable Meters and Data

Only programmable meters capable of supporting passwords or other protection means to restrict access to information contained therein shall be used for Direct Access, and a security password shall be applied to prevent unauthorized access to a programmable meter and unauthorized modifications of the meter data and program. Passwords should be controlled by following generally accepted practices.

II.3. Site Verification

Visually inspect all meter sites for the following conditions:

II.3.1. Direct Access Metering Verification

II.3.1.1. Check for proof of Direct Access meter certification or meter types that meet the CPUC requirements for Direct Access.

II.3.1.2. Verify for correct customer and customer account (records versus meters) including billing constant, meter number, accuracy test results, customer information, address, etc.

II.3.1.3. Verify for correct meter for service characteristics (voltage, form, etc.).

II.3.2. Direct Access Communication Verification

II.3.2.1. Verify for correct phone or other communication devices and connections if remote read

II.3.2.2. Verify for successful communication handshakes and data retrieval if remote read (This can be done by another person at a remote location, and data accuracy is not verified at this time).

II.3.2.3. Verify for successful meter reading if manual read.

II.3.3. Transformer-rated Meter Sites

II.3.3.1. Billing Constant: Compare between records versus sites (CT's / PT's ratios when accessible).

II.3.3.2. Improper Wiring: Shorted current by-pass links, reverse current secondary wired, unmatched voltage and current circuits, pinched or rubbed secondary wires near panel hinges, etc.

II.3.4. Pole-mounted Meter Sites

II.3.4.1. Cutouts: Open cutouts or blown triple link fuses.

II.3.4.2. Grounding: Grounding electrode conductors and connections shall not be broken at any point between the service equipment enclosure and the ground rods or other approved grounding electrode.

II.3.5. Pad-mounted Meter Sites

II.3.5.1. Primary Metering

II.3.5.1.1. Verify meter enclosure attached to primary metering cabinet secured and lockable.

II.3.5.1.2. Verify meter pedestal installation mounted securely and cabinet lockable.

II.3.5.2. Cabinets: Check the cabinet is free of obvious shipping damage, paint damage, or corrosion.

II.3.5.3. Cabinet Safety

II.3.5.3.1. Verify that there is at least one penta-head security bolt permanently attached to high voltage compartment door(s) and door locking handle.

II.3.5.3.2. Verify secondary non-polarity neutral points and meter enclosure / pedestal electrically connected to ground bus.

II.3.5.3.3. Verify all metering electrical connections secured and properly made.

II.3.5.4. Cabinet Markings

II.3.5.4.1. Verify exterior warning labels properly attached

II.3.5.4.2. Verify electrical schematic and metal nameplate mounted to the enclosure

II.3.6. Grounding

Some three-phase, three-wire services have a ground connection on one of the phases. In situations where A, B, or C phase is not grounded and there is a voltage reading at or near zero volts on any phase and reading above zero volts on any other phases, this hazard shall be reported to the UDC prior to leaving the site for emergency corrections and the customer or customer's representative shall be contacted to inform them of the hazardous conditions. If it is unclear whether a phase is intentionally grounded, the local UDC shall be contacted to clarify the configuration of the service. Additionally, extreme caution must be taken on primary (above 600 V), 480 V phase-to-phase or 277 V phase-to-ground service.

II.3.7. Watt Load Clock

Calculate and record customer's load as needed.

II.3.8. Customer's Ground Fault Protection Device

Check for the existence of a ground fault protection device or equipment in customer's electrical panel or switchboard. The purpose of this verification is to ensure that meter workers, while performing meter work on a customer's three phase, 4-wire wye metering installation, do not inadvertently cause an unscheduled interruption on this service.

II.3.8.1. Background

Ground-fault protection shall be provided for solidly ground wye electrical services of more than 150 V to ground, but not exceeding 600 V phase-to-phase for each service disconnecting means rated 1000 A or more. The proper operation of some ground-fault detection systems requires a single neutral-ground point which can be established by connecting the neutral, the equipment grounding conductors, and the service equipment enclosures. Even though this protection is mandatory on all new 1000 A 277/480 V services, some customers may have installed it on lower voltage and amperage of a 4-wire wye service. Therefore, meter workers must follow the procedures below to avoid unscheduled service interruption while performing meter work on 4-wire wye metering installations.

II.3.8.2. Procedures

II.3.8.2.1. Visual check

Prior to performing meter work, visually inspect for the existence of a ground fault protection device in the customer's panel, switchboard, or electrical facilities. Note: One of the most sensitive ground fault protection devices is the GTE-Sylvania Zinsco Model GTS-3 relay. A silicon control rectifier (SCR) in this relay could be triggered by transients generated simply by opening or closing the by-pass potential switch.

II.3.8.2.2. Actions

If a ground fault protection device is found, the meter worker must contact the customer and request that the customer's representative render the ground-fault relay inoperative or be present to witness the meter work performed.

II.3.9. PT/CT Secondary Wiring

If accessible, secondary wiring shall be verified for correct wiring and no sign of tampering, and PTs and CTs shall be checked for normal operating conditions. If abnormal conditions exist, the MSP shall notify the UDC serving the customer within 24 hours for their corrective actions.

II.4. Meter Install

Below are the required procedures that a meter worker must follow when installing and/or removing meters. These procedures do not necessarily include all procedures of a meter installation.

II.4.1. Pre-Installation

Verify type and size of metering is appropriate for site.

II.4.2. Self Contained Meters

II.4.2.1. Take closing read on existing meter.
II.4.2.2. For meters with no bypass, check the load to make sure it is safe enough to remove the meter or disconnect load before replacing the meter.
II.4.2.3. For meters with a bypass, the meter socket shall be bypassed and de-energized, before replacing the meter.
II.4.2.4. Verify voltage.
II.4.2.5. Verify 0 volts between line and load side of test blocks.
II.4.2.6. Install new meter.
II.4.2.7. Take initial meter read.

II.4.3. Transformer Rated Meters (CT Meter)

II.4.3.1. Take closing read on existing meter read.
II.4.3.2. Open test switch cover and verify voltages at the test switch.
II.4.3.3. Operate test switch/test block to de-energize meter sockets.
II.4.3.4. Install new meter.
II.4.3.5. Check voltage before closing voltage switches on test switch.
II.4.3.6. Take initial meter read.

II.4.4. Meter Installation at New Sites

Installation of a meter(s) on a newly constructed premise where the customer has decided, prior to service connection, to sign up for Direct Access service must be treated differently than a change meter order. The parties (ESP, UDC, and MSPs) shall work together to achieve new meter sets and service connection in a timely manner, consistent with the customer's interest and public safety.

A new meter set is defined as a meter socket having a meter installed for the first time. This does not apply to a socket or panel replacement due to equipment failure.

There are four (4) key elements which must be completed prior to a UDC authorizing a new meter set:

1) Customer's application on file with the UDC,
2) Direct Access Service Request (DASR) accepted by the UDC,
3) UDC's receipt of authority having jurisdiction's (AHJ) inspection clearance, and
4) Service completion, or coordination for energizing service.

The UDC will issue an authorization to set a new meter and notify the ESP if coordination is required (i.e. for instrument transformer rated metering). If coordination is required, the MSP shall use best efforts in meeting the UDC schedule. If no coordination is required, the MSP shall set the new meter within two (2) working days of UDC notification.

Should an ESP install a new meter without authorization from the UDC, the ESP's Service Agreement with the UDC shall be subject to termination pending a CPUC formal investigation.

II.4.5 Rewires and Service Upgrades

If a customer rewires or upgrades their electrical service and metering equipment and if required, the MSP may remove the meter before the work on metering equipment starts. Reinstallation of the meter is subject to the same requirements of Section II.4.4.

Should an ESP reset and reseal an existing meter in newly replaced metering equipment without authorization from the UDC, the ESP's Service Agreement with the UDC shall be subject to termination pending a CPUC formal investigation.

II.4.6. Locking Device

Insure appropriate locking device is in place.

III. METER MAINTENANCE AND TESTING SCHEDULE

The primary purpose of the maintenance and testing program is to assure that the meter population owned by an entity is accurate as long as the meters are in service. The required maintenance and testing program is a balance between the benefits and costs of maintaining and achieving high accuracy levels throughout a meter life. This maintenance and testing program enables the entity owning the meters to verify the accuracy of the overall meter systems and to test the meters periodically and / or on the basis of an annual statistical sampling plan.

III.1. Maintenance Schedule

Electric meters used in Direct Access shall be maintained, as a minimum, according to the following meter maintenance and testing schedule:

Table III.1-1; Minimum meter maintenance and testing schedule

Maintenance and Testing Frequency	Customer Maintenance and Testing Criteria
One Year Interval	Customer's annual usage of 2 million kWh or higher
Two Year Interval	Customer's annual usage between 720,000 and 2 million kWh
Annual Statistical Sample Plan	Non residential customer's annual usage less than 720,000 kWh
Residential Meters	Either a formal sampling plan performed annually or tests done upon request and removal, where applicable
Direct Current (DC) Meters	Either a formal sampling plan performed annually or tests done upon request and removal, where applicable

III.2. Maintenance upon request

Testing and maintenance is required upon a reasonable request by a customer, ESP, or UDC. Prior consultation between the parties shall determine the entity that would perform the test and maintenance.

III.3. Statistical Sampling Requirements

The ANSI Z1.4 or Z1.9 Standards shall be used as the statistical sampling requirements for testing meters. Generally, inspection level of General II (G-II) shall be used if the use of other inspection levels is not justifiable.

III.4. Criteria for required corrections

The criteria for required corrections on the overall meter population include the trigger criteria and action criteria, which are specified in Table III.4.1 below:

Table III.4.1. Criteria for required corrections

Sampling plan applied on:	Trigger Criteria	Action Criteria
- Overall meter population	**2.5% AQL**	**4% AQL**
- A group of meter type	**2.5% AQL**	**10% AQL**

AQL is the Acceptable Quality Levels, which is the maximum percentage of non-conforming meters in the meter group. The non-conforming meters are those sample meters that are tested and found outside the CPUC-required accuracy limits. The current CPUC-required accuracy limits are ±2%. The overall meter population includes all meter types owned by an entity and is not divided into any groups of meters or meter types.

When the trigger criteria of 2.5% AQL is not met during a scheduled maintenance and testing, the second or more sampling plans for further testing and checking shall be required to monitor the accuracy performance of the overall meter population, groups, or types. Upon the violation of the action criteria, corrective actions shall be taken to correct the problems. Such corrective actions may lead to removals of certain inaccurate and aging meter groups or types.

III.5. Troubleshooting and Corrective Actions

Troubleshooting shall include all applicable tasks as indicated above and shall be performed to verify the meter operation and accuracy as required. If the troubleshooting indicates a hazard or out-of limit accuracy condition at a meter site, the responsible party shall take corrective actions within 48 hours of this finding.

III.6 MDMA Communications

The MSP will notify the MDMA of a problem with the meter. The MDMA is ultimately responsible for the quality of the data from the meter and will confer with the MSP regarding potential data problems with the meter. The MDMA will determine if the meter data should be adjusted, including the cause and correction factor.

III.7. Demarcation Point of Meter Work

As part of these meter worker qualifications, a clear scope of metering work must be established. CPUC D.98-12-080 reaffirms D.97-10-087, Appendix A: Direct Access Tariff, Section H(1)(b) which states,

"Potential and current transformers shall be considered part of the distribution system and shall remain the responsibility of the UDC."

Accordingly, and pursuant to D.97-10-087 and D.98-12-080, all instrument transformers, test switches, and associated wiring up to the meter socket shall remain the responsibility of the UDCs. However, per D.98-12-080, reconnecting existing wires to a replacement of the existing meter socket, A-base socket adapter, or A-base meter may be performed by either UDCs or MSPs.

IV. METER SYSTEM TESTING

The following meter system testing requirements shall be applied to: 1) ensure the accuracy of the overall metering system at a customer site within the CPUC-required limits, 2) ensure safety in meter work procedures, and 3) provide a consistency of testing once such testing is performed for a Direct Access customer.

In general, there are seven tasks involved in testing an electric meter system. The metering system, defined for use in Section IV only, is 1) the meter itself, or 2) the meter and its attached equipment or module(s). These tasks are described in Section VI, Guideline for Meter Testing, which meter workers may use as a guideline for their meter work.

The following requirements shall are applied when testing is performed on meters, meter sockets, and metering systems:

IV.1. Meter Socket

Voltage test (Task #1 in Section VI) shall be performed on meter sockets or service connections to verify correct voltages. When a phase shifting transformer is in use, a phase angle test (Task #5 in Section VI) shall be required (if load is present).

IV.2. Metering System

The following tests are required to be performed on a metering system:

- IV.2.1 Light and full load test or customer load test (Task #2 in Section VI).
- IV.2.2 Demand test (Task #3 in Section VI).
- IV.2.3 Register verification (Task #4 in Section VI).
- IV.2.4 Separate element check (Task #6 in Section VI).

IV.3. Notification

Meter worker shall notify the UDCs, ESPs, and MDMAs upon finding a defective meter that affects billing.

V. TEST STANDARDS

V.1. Calibration and Maintenance of Test Standards

The following are the requirements for maintenance and calibration of test standards which are used for testing the accuracy of electric meters in the field or in the shop:

V.1.1. Out-of-calibration

A test standard that is found to have accuracy outside the limits of ±0.1% of a reference test standard.

V.1.2. Basic Reference Test Standard

A basic reference test standard that is certified according to NIST requirements and used as an accuracy reference in the laboratory or meter shop.

V.1.3. Portable Test Standard

A portable test standard that is used to certify the accuracy of meters in the field.

V.1.4. Routine Accuracy Check Requirements

Each test function of a test standard shall be checked and compared with a reference standard monthly. If a test standard used in testing meters has a result of three consecutive meters tested out of the CPUC-required accuracy limits, this test standard shall be checked against the reference standard.

V.2. Meter Re-testing upon Finding of An Out-of-calibration Test Standard

Once a test standard is checked and found out-of-calibration, it shall be calibrated according to NIST requirements, and meters that were tested by this test standard since the last routine check or calibration of the test standard shall be re-tested with an accurately-calibrated test standard according to the following:

V.2.1. A meter sample from the meters tested by this portable standard since its last check or calibration shall be selected for re-testing as follows:

- **V.2.1.1.** 3–20 meters: All meters will be re-tested for accuracy.
- **V.2.1.2.** 21–100 meters: A random sample of 20% or 20 meters, whichever is less, will be retested for accuracy.
- **V.2.1.3.** 101–200 meters: A random sample of 10% or 20 meters, whichever is less, will be retested for accuracy.
- **V.2.1.4.** Over 200 meters: A random sample of 10% or 50 meters, whichever is less, will be retested for accuracy.

V.2.2. If at least 95% of the first sample pass the meter test for accuracy, all meters will be considered accurate.

V.2.3. If less than 95% of the first sample pass the meter test for accuracy, a second sample of the same size will be tested.

V.2.4. If a second sample is drawn, 95% of the sample meters must pass the meter test standard for accuracy.

V.2.5. If less than 95% of the second sample pass the meter test for accuracy, all meters previously tested by the portable standard will be re-tested and re-calibrated for accuracy.

VI. GUIDELINE FOR METER TESTING

Matrix of Meter System Testing

The following matrix indicates which testing task can be applied to a meter technology, and it serves as a guide in meter testing. Some of the specific tasks may not apply to newer meters:

		TASK									
CODE	**Type of Meters/Registers**	**1** Voltage Test	**2** Light & Full Load or Customer-Load Test	**3** Demand Test	**4** Register Verification	**5** Phase Angle Test	**6** Separate Element Check	**7** Burden Test	Possible Other Types ❹	COMMENTS	**CODE**
(a)	Self-Contained kWh Meters	**X**	**X**						**(g), (j)**	Mechanical Meter	**(a)**
(b)	Transformer-Rated kWh Meters	**X**	**X**				**X**	**X**	**(g), (j)**	Mechanical Meter	**(b)**
(c)	Hybrid Meters	**X**	**X**	**X**	**X**		**X**		**(i), (j)**		**(c)**
(d)	Solid State Meters	**X**	**X**	**X**	**X**				**(g), (i), (j)**		**(d)**
(e)	Transformer-Rated kVARh Meters	**X**	**X**			**X**	**X**	**X**	**(j)**	Mechanical Meter	**(e)**
(f)	Multi-Quadrant Meters	**X**	**X**		**X**		**X**		**(g), (j)**		**(f)**
(g)	Solid State Recorders	**X**		**X**							**(g)**
(h)	Mechanical Registers								**(g), (j)**		**(h)**
(i)	Electronic Registers								**(g), (j)**		**(i)**
(j)	Pulse Devices			**X**							**(j)**
(k)	Self-Contained Network Meters	**X**							**(g), (j)**		**(k)**

Performed if demand is present. Energy Consumption Investigation (ECI) is necessary. Performed when deemed necessary or requested by customers.

The alphabetical codes in the "Possible Other Types" column refer to the "Code" column on this matrix and indicate that additional tests must be performed as required if the other types exist at the sites.

VI.1. Task #1: Voltage Test

The voltage test is necessary to 1) ensure safety in the meter work procedures, 2) provide a meter worker a knowledge of the correct service voltage prior to any meter work, 3) provide a confirmation of no short-circuit or hazardous conditions in customer equipment or panel. Below is a procedure for the voltage test:

On all services, measure the secondary voltage, with an approved volt meter, between the line phases and line to ground even if it is an ungrounded service and record all voltage readings on the test tag. All nominal voltages have an allowable tolerance of ±5%.

VI.1.1. Secondary Distribution Voltages

Normal rating of 120 V.

Table VI.1.1-1: Nominal Voltages and allowable limits on Secondary

Nominal Voltage (V)	Maximum (V)	Minimum (V)
120	126	114
208	218	198
240	252	228
277	291	263
480	504	456

TableVI.1.1-2: Service Voltages and allowable limits on Secondary

Service Voltage (V)	Measured Voltage (V)	Maximum (V)	Minimum (V)
120/240 V 3w 1ø	120 V Phase to Ground 240 V Phase to Phase	126 252	114 228
120/208 V 3w 1ø	120 V Phase to Ground 208 V Phase to Phase	126 218	114 198
120/208 V 4w 3ø	120 V Phase to Ground 208 V Phase to Phase	126 218	114 198
120/240 V 4w 3ø	120 V Phase to Ground 208 V Phase to Ground 240 V Phase to Phase	126 218 252	114 198 228
277/480 V 4w 3ø	277 V Phase to Ground 480 V Phase to Phase	291 504	263 456
240 V 3w 3ø	240 V Phase to Phase	252	228
480 V 3w 3ø	480 V Phase to Phase	504	456

VI.1.2. Primary Distribution and Transmission Voltages

These voltages have a secondary voltage rating of 115 V or 120 V. The voltage transformer primary may be connected either wye or delta.

Table VI.1.2-1: Primary and Transmission Voltages with their secondary voltages and ratios

Possible System L-L Voltage (V)	VT Primary Voltage (V)	Secondary Rating (V)	Ratio
2,400 or 4,200	2,400	120	20:1
4,200 or 7,200	4,200	120	35:1
7,200 or 12,000	7,200	120	60:1
12,000 or 20,125	12,000	120	100:1
17,200	18,000	120	150:1
20,125 or 34,500	20,125	115/67.08	175/300:1
60,000	34,500	115/69	300/500:1
69,000	40,250	115/67.08	350/600:1
115,000	69,000	115/69	600/1000:1
138,000	80,500	115/69	700:1
230,000	138,000	115/69	1,200/2000:1
500,000	287,500	115/69	2,500/4200:1

VI.2. Task #2: Light Load & Full Load Test or Customer-Load Test

This test is the accuracy testing to assure that the meter is accurate at various load conditions. Typically, the accuracy of the solid state meters varies minimally in the full and light load conditions. However, the accuracy of mechanical meters is significantly better at a full load than at a light load due to friction and speed of disk shaft rotation. Therefore, it becomes a common practice to test meters for accuracy at both light and full load conditions.

Light load is 10% of test Amp rating, and full load is 100% of test Amp rating. The light and full load test is performed at 100% power factor to verify the accuracy of the meter by comparing its test results with a standard meter of known traceable accuracy. Customer Load Test will consist of two or more test runs using the customer's load. Each heavy load test run shall be at least 60 seconds in duration. Heavy load is defined as any load over 10% of Test Amp rating of the meter. Each light load test run shall be at least 90 seconds in duration and two revolutions of the meter disk

VI.2.1. No Load or Creep Test (for mechanical & hybrid meters only)

Test meters will be energized with no connected load, and the disk observed for rotation. A minimum amount of creep is acceptable if the rotation stops when an anti-creep hole reaches the meter stator.

VI.2.2. Accuracy test

Single phase and polyphase meters are to be tested with potential coils connected in parallel and the current coils connected in series; or an on site test can be performed using customer load. The minimum duration of the test will be 1 disk revolution for light load and 10 disk revolutions for full load. For solid state meters, calculated pseudo revolutions will be used. Customer Load test will be at least 60 sec in duration and minimum 2 revs for heavy load test. Light load test run at least 90 sec in duration and two revolutions of the disk

VI.2.3. Adjustments

Meters found within the limits required by the local UDC need not be adjusted.

VI.2.4. Reporting

Correction factors for light load and full load tests will be recorded as the meter accuracy results as specified in ANSI C.12.1 (1995)

For example, for a 0.5% fast and slow meter:

	Correction Factor	Accuracy
Fast	0.995	+0.5%
Slow	1.005	-0.5%

VI.3. Task #3: Demand Test

The demand test is performed to ensure the accuracy of the demand function of a meter.

VI.3.1. Mechanical Demand Meters

Test for the accuracy of the demand registers by checking the marked register ratio and time interval as follows:

VI.3.1.1. Advancing Mechanism: Visually inspect the pusher arm and gears for worn out parts.

VI.3.1.2. Clutch: Check that the pusher arm returns to zero at the end of interval when the clutch releases it. Verify that this is a smooth operation and that the pusher arm returns to the stop position.

VI.3.1.3. Timing Motor: Check that the timing motor is operating. If the motor is not operating, the demand reading will most likely be off scale.

VI.3.1.4. Time Interval and Demand Test: Test the time interval to ensure that it is as marked on the register name plate by timing the motor gear and clocking an interval (i.e. 900 seconds for 15 minutes), or performing a demand test. The demand test is performed by minimally applying full load current for 125 disk revolutions on 15 minute demand meters and for 250 disk revolutions on 30 minute demand meters.

VI.3.1.5. Demand Mechanism: Check that the demand reset returns the pointer to zero on a reset action and that the pointer will advance to full scale.

VI.3.1.6. Reporting: Correction factor for the demand test will be recorded as the meter accuracy result.
For example for a 0.5% fast and slow meter:

	Correction Factor	Accuracy
Fast	0.995	+0.5%
Slow	1.005	-0.5%

VI.3.2. Solid State Meters and Electronic Registers

Below is a procedure for a demand test on a solid state meter or an electronic register:

VI.3.2.1. Place the meter register in the TEST MODE.

VI.3.2.2. Press the reset button to clear all test registers and start a new demand interval.

VI.3.2.3. Apply full load current for 25 disk revolutions (or equivalent) as a minimum.

VI.3.2.4. Scroll the register display to show present kW demand. If the kW value is in pulses, calculate the actual kW value.

VI.3.2.5. Calculate and record the correction factor by comparing the meter kW value with the kW in the test standard.

VI.3.2.6. Return the meter to the NORMAL MODE.

VI.4. Task #4: Register Verification

The register verification is performed to ensure that the register parts and components are working to provide and retain accurate billing data and information.

VI.4.1. Mechanical Register

Visually inspect and verify that the register is correct for the watt-hour meter, and that the register constant, gear ratio, and register ratio are correct for the register.

VI.4.1.1. Gear mechanism: Check that the gears are clean, and check the proper engagement between gears and between the first gear and the disk shaft.

VI.4.1.2. Mechanical register: Check that the register ratio is the same as marked. The register ratio (Rr) is determined by counting the number of revolutions required of the first gear to cause the first dial pointer to make one complete revolution.

VI.4.2. Electronic Register

Because electronic registers are different for each type and manufacturer, the manufacturer's manual should be referred to for specific procedures for these registers. Below is a typical procedure for verifying electronic registers after they are programmed with proper parameters:

VI.4.2.1. Check all numerical segments and identifiers on the meter display.

VI.4.2.2. Check that the meter is scrolling properly through all registers.

VI.4.2.3. Check the function of the registers by disconnecting and then restoring power on the meter. The meter should resume normal display operations and reading after this power outage.

VI.4.2.4. Verify the programming parameters are correct.

VI.4.2.5. Check the register memory and load profile data memory to verify that data is being stored.

VI.5. Task #5: Phase Angle Test

The phase angle test is performed to ensure the correct wiring for a meter system and therefore ensure the meter site accuracy because the correct wiring depends on a unique phase rotation (ABC or CBA) supplied by a UDC, customer load, and service wiring (delta vs. wye and three wires vs. four wires). The following is an example of procedures to follow when performing a phase angle test:

VI.5.1. Utility Phase Rotation Requirements

Refer to specific UDC requirements regarding phase rotation prior to performing this test, and check for correct wiring on a reactive metering site and proper phase shift on each phase circuit.

VI.5.2. Phase Shifting Transformer (Reactaformer) Voltage

Measure the secondary voltage to ensure correct voltage is applied to the potential coil in the kVarhr meter. If the phase voltage is not correct, check for the following possible errors: 1) incorrect wiring on the phase shifting transformers, and 2) incorrect service voltage.

VI.5.3. Power Factor Calculation

Calculate the load on the (real power) kWhr and the (reactive power) kVarhr meters and the power factor for the site. This power factor is used as a cross check for the measured phase angles.

VI.5.4. Current Measurement

Measure each phase current and record it accordingly.

VI.5.5. Phase Angle Measurement

Use a phase angle meter to measure each phase angle and record it accordingly.

VI.5.6. Phase Angle Plot

After measuring all voltages, currents, and phase angles, plot a phase angle test and cross check with the calculated power factor.

VI.6. Task #6: Separate Element Check

The separate element check is performed to ensure that each element is still in a good working condition. This check is necessary because a meter has more than one element, and it still measures energy usage even if one element is burnt or defective.

Check individual elements for proper disk rotation or registration by performing the following:

VI.6.1. Testing

Energize with the appropriate phase potentials and place current on individual elements, and check for forward rotation or positive registration

VI.6.2. Correct phasing

Check that the proper potential coil and current coil are wired correctly in the meter. If the meter is installed correctly on the socket, the meter disk will rotate forward.

VI.6.3. No forward rotation

If an element has no rotation, check for no load current and for open potential coil(s) with a magnet or an ohmmeter.

VI.6.4. Cautions

Phase angle relationships may cause reverse rotation in cases where there is a poor power factor, possible un-metered load, and/or short circuit. This will only occur on three wire three phase metered service sites.

VI.7. Task #7: Burden Test

Burden is the total load or impedance in the current transformer (CT) circuit due to meter coils, leads, and other connected devices. The burden test is performed to check for the proper operating conditions of CTs. This test is necessary to verify that the output current is proportional to the CT's nameplate ratio. Below is an example procedure for the burden test on a CT:

VI.7.1. Procedure

Put built-in burdens of a multi-range Ammeter in series with the secondary of the test CT to obtain the Amp readings. These Amp readings should have the same deflection.

VI.7.2. Possible Problems

If a CT has a reading significantly different from the others, check for shorted turns or other problems, such as short circuited primary turns, short circuited secondary turns, high resistance connections in the secondary circuit, short circuited secondary wiring, or grounding of normally ungrounded wire.

GLOSSARY OF TERMS

Adjustment: Any change to a customer's usage data made to correct an error in the original data.

Average Daily Usage (ADU): Average daily usage over a specified period of time, such as a billing period. For example, if all constants and factors have already been applied to the reads, the ADU could be calculated by: ADU = (current billing read - previous billing read)/(# days between billing reads).

EDI Implementation Guideline: Defines the EDI environment for using conventions within an industry, and provides assistance on how to implement the X12 standard. The Utility Industry Group (UIG) establishes Implementation Guidelines for the utility industry.

Direct Access (DA): A service option where the customer obtains its electric power and ancillary services from an Energy Service Provider.

Electricity meter: A device that measures and registers the integral of an electrical quantity with respect to time.

Electronic Data Interchange (EDI): The computer-application-to-computer-application exchange of business information in a standard format. In the context of this report, EDI refers to use of the ANSI X12 standards.

Energy Service Provider (ESP): The party that contracts with the end-use customer to provide commodity electric service.

End-Use Customer: A customer that takes final delivery of electric power and does not resell the power.

Estimated data: Usage or demand data that has been calculated based on standard estimation rules.

Interval data: Metered end-use data from a meter capable of recording actual energy usage for each time interval (e.g., hour, half-hour, etc.) during the billing cycle.

Irregular usage customer: Customer whose usage pattern does not follow normal usage patterns and consistently fails validation checks.

KYZ (contact output): A device coupled to a sensor or meter which produces incremental pulses with a defined value of the measured media. Also known as "Relay output Form C" in certain ANSI designations.

Local Meter Reading: The reading of meters accomplished by physically visiting individual customer premises or meter installation sites.

Meter: A device for measuring and totaling the variable consumption of a product. In general, a meter consists of a sensor that detects and measures a flow, and an integrating device and register that displays the total consumption in metrological units.

Meter Data Management Agent (MDMA): An entity who performs a function which entails acquiring raw end-use data, performing VEE to create validated data, providing validated data to specified market participants, and maintaining an archive of raw and validated meter data.

Meter Product: A device which measures, calculates, records and/or communicates energy consumption data for the purpose of determining the financial obligation for an entity consuming energy. Shall include any optional circuit boards, devices, or modules enclosed within the meter cover.

> In-inventory Meter Products: Meter products that have been purchased and stored in inventory, but not yet installed for Direct Access service in California. This does not include used, re-worked, or recycled meters.
>
> In-service Meter Products: Meter products that have been approved and are currently in service for Direct Access.
>
> Recycled Meter Products: Used meter products that are cleaned, tested, for accuracy and good operating condition, and returned to inventory.
>
> Retrofitted Meter Products: In-inventory or used meter products that are retrofitted with electronic modules.
>
> Re-worked Meter Products: Used meter products that are repaired, rebuilt, or refurbished. These do not include recycled or retrofitted meter products.
>
> Used Meter Products: Meter products that are removed from service.

Meter Service Provider (MSP): The MSP function includes provision of the meter instrument, installation, testing, maintenance, programming, and possibly metering local area network (LAN).

Meter Type: The design and specifications for a meter product which includes all parts, components, and circuit boards, functioning as a unit. A meter type includes all communication technologies and any additional functions utilized by that meter type and operated as a unit. In a situation where a meter can work with multiple technologies or functions, but can only operate separately and individually with a single communication technology or function, the combination of the meter and one

communication technology or function shall be considered as a different meter type from the combination of that meter and another communication technology or function. For example, meter brand "X" with a phone modem attached is a different type from the same meter brand "X" with a radio modem attached.

New Meter Type: Meter type that satisfies CPUC requirements described in the DASMMD. This meter type can be a new meter design or an existing meter which has undergone a significant design change. A significant design change includes addition of a new circuit board with new meter function(s) not previously used with the meter type, or consolidation of two or more circuit boards.

Pulse overflow: Condition in which the actual usage during an interval is larger than can be captured by the meter or recorder.

Raw data: Usage or demand data that has not gone through the validation, editing and estimation (VEE) process.

Re-framing: Changing the time frame of the metered usage data posted to the MDMA server. This typically refers to changing the beginning or ending date/time of the usage data.

Regulations or regulatory requirements: Requirements imposed by the CPUC or other regulatory entity; i.e., "rules & regulations."

Reliability: The probability of a product or system performing without failure a specified function under given conditions for a specified period of time.

Remote Meter Reading: The reading of meters accomplished without physically visiting individual customer premises or meter installation sites.

Specifications: Particular qualitative and quantitative attributes of a technical system or its elements, upon which the functionality of that system or its suitability for a particular purpose depends.

Standards: Specifications established or promulgated by an official standards body, such as IEEE, ANSI, etc., for public use.

> Closed Standards: Standards that are not open, i.e., that fail to meet any of the four criteria for open standards.
>
> De Facto Standards: Standards that are widely used in product design or referred to by industry participants without having been sanctioned by a recognized standards body.
>
> Direct Access Standards for Metering and Meter Data: Standards that are approved as regulatory requirements for metering and meter data used in Direct

Access in California by the California Public Utilities Commission in its D.98-12-080 issued on December 17, 1998.

International Standards: Open standards as adopted by an international standards body; the U.S. participates in ISO, IEC, and others.

National Standards: Open standards As adopted by a standards body accredited to a national standards body; in the U.S., ANSI Standards.

Open Standards: Voluntary standards which are: (1) developed in an open forum, (2) sanctioned by an official standards body, (3) vendor-neutral, and (4) readily available to the public at a reasonable cost.

Proprietary Standards: Standards which are privately owned and for which access may be unilaterally withdrawn or otherwise restricted.

Test mode: Period during which a test load is applied to a meter or recorder to verify its accuracy.

Utility Distribution Company (UDC): The restructured descendent of an existing CPUC-regulated electric utility which provides distribution services, and is the default provider of energy and revenue cycle services.

Utility Industry Group (UIG): A utility industry action group that represents members to ASC X12. UIG develops, promotes, and establishes conventions for the use of EDI standards, guidelines, and tools in the utility industry. Membership includes utilities, customers, suppliers, service providers, and liaisons to other organizations.

Validation check: Data check designed to identify usage or demand data that may not reflect actual usage, typically due to problems at the meter or recorder.
Valid data. Usage or demand data that has gone through all required validation checks and either passed them all or has been verified.

Valid data: Usage or demand data that has gone through all required validation checks and either passed them all or has been verified.

Validated Data: Usage or demand data that has been validated, edited and estimated (VEE) in accordance with approved procedures.

VEE: Validating, Editing, and Estimating. Validation is the process of performing standardization validation checks on usage and demand data. Estimating is the process of using standard estimation rules to calculate usage or demand data. Editing is the process of inserting estimated values into a validated data stream that has errors, gaps or omissions.

Glossary of Terms and Acronyms

Verified data: Usage or demand data that failed at least one of the required validation checks but was determined to represent actual usage.

Watt-hour meter: An electricity meter that measures and registers the integral, with respect to time, of the active power of the circuit in which it is connected. The power integral is the energy delivered to the circuit during the integral over which the integration extends, and the unit in which it is measured is usually the kilowatt-hour. (ANSI C12.1)

GLOSSARY OF ACRONYMS

ADU: Average Daily Usage
ANSI: American National Standards Institute
D: Decision
DA: Direct Access
DASR: Direct Access Service Request
DAWG: Direct Access Working Group
DQIWG: Data Quality and Integrity Working Group
CMEP: California Metering Exchange Protocol
CPUC: California Public Utilities Commission
CT: Current Transformer
EDI: Electronic Data Interchange
ESP: Energy (Electric) Service Provider
FCC: Federal Communications Commission
ISO: Independent System Operator
kVARh: kilovar-hours
kWh: kilowatt-hours
MDCS: Meter and Data Communication Standards
MDMA: Meter Data Management Agent
MSP: Meter Service Provider
NEC: National Electric Code
PG&E: Pacific Gas and Electric Company
PSWG: Permanent Standards Working Group
PT: Potential Transformer
RSIF: Retail Settlements and Information Flows
SC: Schedule Coordinator
SCE: Southern California Edison Company
SDG&E: San Diego Gas and Electric Company
TOU: Time-of-Use
UIG: Utility Industry Group
UDC: Utility Distribution Company
V: Volts
VEE: Validating, Editing and Estimating