

the test; a statement as to whether or not the meter "creeps" and in case of creeping, the rate; a statement of "as found" and "as left" accuracies sufficiently complete to permit checking of the calculations employed; indications showing that all required checks have been made; a statement of repairs made, if any, and identification of the testing standard and the person making the test.

(2) Each utility shall keep a record for each unit of metering equipment showing when the unit was purchased; its cost; utility's identification; associated equipment; essential name-plate data; dates of tests; results of all "as found" and "as left" tests unless separate records are kept of each test for each unit; and locations where installed with dates of installation and removal.

(3) Each utility shall summarize yearly in a combined tabulation all individual meter and overall light and heavy load "as found" tests at the power factors as required by these rules. This summary shall be divided according to length of meter test period, and separately for single-phase, polyphase, and direct-current meters. The summary shall show the number of "as found" tests found within each of the following accuracy classifications: not recording; 94.0% and under; 94.1% to 96.0%; 96.1% to 98.0%; 98.1% to 99.0%; 99.1% to 100.0%; 100.1% to 101.0%; 101.1% to 102.0%; 102.1% to 104.0%; 104.1% to 106.0%; and over 106.0%. The accuracy summary for the calendar year shall be submitted to the Commission by April 1 of the following year. As found, tests of other units of metering equipment shall be summarized in a manner consistent with the method of testing employed by the utility. A record shall be kept of the number of complaint tests made each year.

History: 1-2-56; am. (3), Register, December, 1957, No. 24, eff. 1-1-58.

PSC 113.24 Preservation of records. The following records shall be preserved and kept available for inspection by the commission for the periods indicated. The list is not to be taken as comprehending all types of utility records.

<i>Description of record</i>	<i>Period to be retained</i>
Maps showing the location and physical characteristics of existing plants -----	Currently
Engineering records in connection with construction projects -----	Permanently
Production records:	
Station and system generation records	Permanently
All other records taken in the plant	6 years
Operating records:	
Load dispatcher data -----	6 years
Interruption records -----	6 years
Meter test -----	See PSC 113.23
Meter history records -----	Life of meter
Annual meter accuracy summary -----	16 years
Voltmeter records -----	See PSC 113.29
All other records of operation -----	6 years
Equipment record:	
Must be placed in mortality study before destroying -----	Life of equipment
Customers' records:	
Inspection of customers' premises -----	6 years
Customers complaint record -----	6 years
Meter reading sheets -----	* years
Billing record -----	* years
Customer deposits -----	6 years after refund
Filed rates and rules -----	Permanently

Note: See also federal power commission order No. 54, August 30, 1938, and public service commission orders in dockets 2-U-1089, June 3, 1937, and 2-U-1116, July 20, 1937, prescribing classification of accounts.

* Where machine billing is used and meter readings recorded on tabulating cards the register sheets may be considered the "meter reading sheets" and the "billing records." "Meter reading sheets" and "billing records" or the "register sheets" shall be kept 6 years or until they are no longer needed to adjust bills. This means that the records must be kept 6 years or from the date of one meter test to the next whichever is longer.

Register, December, 1957, No. 24

PART V

VOLTAGE, CURRENT, AND FREQUENCY STANDARDS

PSC 113.25 Standard and maintenance of voltage. Each utility shall adopt standard nominal service voltages for each of the several areas into which the distribution system or systems may be divided, and shall file with the commission a statement of the standard voltages adopted. The voltage maintained at the point of attachment of the customer-owned service to the company-owned conductors, shall be reasonably constant within the following limits:

(1) (a) For all retail service, except power service, rendered in urban communities in which the utility serves 500 or more separate customers, the variation of voltage shall be no more than 5% above or below the standard voltage at any time and in addition:

(b) For commercial customers who must depend on electricity for lighting a large part of the time, the variation of voltage from maximum to minimum shall not exceed 6% of the standard voltage from 8 a.m. to 11 p.m. For all others, including residential customers, the 6% variation shall apply from one-half hour before sunset to 11 p.m.

(2) (a) For all retail service except power service rendered in urban communities in which the utility serves between 100 and 500 separate customers, the variation of voltage shall be not more than 5% above or below the standard voltage at any time and in addition:

(b) Between the hours of one-half hour before sunset and 11 p.m., the variation of voltage from maximum to minimum shall not exceed 8% of the standard voltage.

(3) (a) For all retail service except power service rendered in rural areas, or in urban communities in which the utility serves less than 100 customers, the variation of voltage shall be not more than 6% above or below the standard voltage at any time and in addition:

(b) Between the hours of one-half hour before sunset and 11 p.m., the variation of voltage from maximum to minimum shall not exceed 8% or the standard voltage.

(4) For retail power service, the voltage variation shall not exceed 10% above nor 10% below the standard voltage. The term "power service" as used herein means service furnished principally for electromotive or industrial purposes and may include service for lighting incident thereto, as defined in the utility's rates and rules.

(5) For retail combined lighting and power service, the voltage variation shall not exceed the limits provided under section PSC 113.25 (1), (2), or (3), as the case may be. In connection with the rates applicable to combined lighting and power service each utility shall file rules and regulations setting forth the characteristics of utilization equipment permitted under the rates.

(6) For service rendered to public utilities and others for resale, the voltage shall be as mutually agreed upon by the parties concerned and shall, except with respect to interchange contracts, be adequate to make possible with standard local regulation, voltage maintenance on distribution systems of standard and adequate construction for the loads carried, which conforms to the requirements of the other provisions of this rule.

(7) The variation of voltage allowed for in (1) to (6), inclusive, shall be a gradual change in voltage as a result of normal changes in load.

(b) Any two or more of at least three watthour meters may be used as a secondary standard to check portable rotating standards provided there is no discrepancy in accuracy between any two of the watthour meters used of more than 0.2% at standard test loads. Calibration and history records shall be maintained for each of the meters used as secondary standards.

(3) Secondary standards indicating instruments shall not be in error by more than plus or minus 0.5% of indication at commonly used scale deflection and shall not be used to check or calibrate portable indicating instruments unless the secondary standard has been checked, and adjusted, if necessary, within the preceding 12 months. A calibration record shall be maintained for each standard.

(4) (a) All working rotating standards when regularly used shall be compared with a secondary standard at least once a week if they are of the commutator type and at least once in every 2 weeks if of the induction type. Working rotating standards infrequently used shall be compared with a secondary standard before they are used.

(b) Working rotating standards shall be adjusted, if necessary, so that their accuracy will be within 99.7% and 100.3% at 100% power factor and within 99.5% and 100.5% at 50% lagging power factor at all voltages and loads at which the standard may be used. A history and calibration record shall be kept for each working rotating standard.

(5) The meter accuracies herein required as to all primary, secondary, and portable standards shall be referred to 100%. Service measuring equipment shall be adjusted to within the accuracies required assuming the portable test equipment to be 100% accurate.

PSC 113.46 Testing of metering equipment. (1) The test of any unit of metering equipment shall consist of a comparison of its accuracy with a standard of known accuracy. Units not properly connected or not meeting the accuracy or other requirements of sections PSC 113.40, 113.41, and 113.42 at the time of test shall be reconnected and rebuilt to meet such requirements and adjusted to within the required accuracy and as close to 100% accurate as practicable or their use discontinued.

(2) Self-contained alternating current meters rated at 12 kv.a. or less together with associated equipment such as demand devices, phase shifting transformers, control devices, etc.:

(a) Shall be checked for accuracy at unity power factor at the point where they are installed or at a central testing point or in a mobile testing laboratory:

1. Within a period of 12 months before to 60 days after they are placed in service.

2. Within a period of 6 months before to 6 months after 96 months of service.

3. When they are suspected of being inaccurate or damaged.

4. When the accuracy is questioned by a customer.

5. Before use when they have been inactive for more than 1 year.

6. When they are removed from service.

(b) Shall be inspected for mechanical and electrical faults whenever the accuracy of the device is checked.

(c) Shall have the register and the internal connections checked before the meter is first placed in service and whenever the meter is repaired.

(d) Shall have the connection to the customers' circuits checked when the meter is tested on the premises or removed, and in the case of three-phase meters, within 60 days after installation.

(e) Shall be checked for accuracy at 50% power factor before first being used for measuring customers' service; whenever tested at a central or mobile testing laboratory and in addition three-phase meters shall be checked at 50% power factor whenever tested.

(f) Need not be tested or checked for any reason (except on complaint) if the device was tested, checked, and adjusted, if necessary, within the previous 12 months.

(3) Self-contained alternating current meters and associated equipment not included in subsection (2) above and metering equipment associated with instrument transformers:

(a) Shall be tested for accuracy at unity power factor:

1. Before being placed in service.
2. On the customer's premises within 60 days after installation.
3. Within a period of 2 months before to 2 months after 24 months' service for metering installations having a capacity of 100 kv.-a. or less and within a period of 1 month before to 1 month after 12 months' service for metering installations having a capacity in excess of 100 kv.-a.

4. When they are suspected of being inaccurate or damaged.

5. When the accuracy is questioned by a customer.

6. Before use when they have been inactive for more than 1 year.

7. When necessary to correct for instrument transformer changes.

8. When they are removed from service.

(b) Shall be inspected for mechanical and electrical faults whenever the accuracy is checked.

(c) Shall have the register and internal connections checked before the meter is first installed, when repaired, when the register is changed, or the instrument transformers are changed.

(d) Shall have the connections to the customer's circuits and multipliers checked whenever the equipment is tested for accuracy on the customer's premises.

(e) Shall be checked for accuracy at 50% power factor before being used for measuring customers' service; whenever tested at a central or mobile testing laboratory and in addition three-phase meters shall be checked at 50% power factor whenever tested.

(4) Instrument transformers shall be tested:

(a) When first received.

(b) When removed from service.

(c) Upon complaint.

(d) When there is evidence of damage.

(e) 1. In conjunction with meters whenever the meter is tested, or
2. Whenever an approved check (such as the variable burden method in case of current transformers) made in conjunction with each field test of the meter indicates that a separate test should be made, or

3. Tested separately every 10 years. When tested separately, the test data shall be recorded and the meters adjusted to insure the overall accuracies specified in sections PSC 113.40, PSC 113.41, and PSC 113.42.

(5) Direct current meters, shunts, and associated equipment:

(a) Shall be tested for accuracy

1. Before the meter is placed in service.

2. On the customer's premises within 60 days after installation.

3. When meter installations having a capacity of 6 kw. or less have been in service 42 months; 6 kw. to 100 kw. have been in service 18

months; and for larger installations when they have been in service 12 months.

- 4. When they are suspected of being inaccurate or damaged.
- 5. When the accuracy is questioned by a customer.
- 6. Before use when they have been inactive for more than 1 year.
- 7. When they are removed from service.

(b) Shall be inspected for mechanical and electrical faults whenever the accuracy is checked.

(c) Shall have the register and internal connections checked before the meter is first installed, when repaired, or the register changed.

(6) Each utility shall promptly make a test of any metering installation upon request of the customer if 6 months or more have elapsed since the last request test of the meter in the same location. The test shall consist of a test for accuracy, and a check of the register and meter connections on the customer's premises. At the customer's request and expense the installation shall be checked for accidental grounds. The customer shall be furnished a report of the result of the test.

(7) Upon application and payment of the following fee to the commission by any customer, the commission will make a test covering the accuracy of the installation, check of connections, and any other check or test which appears desirable. The utility shall reimburse the customer for the fee if the watthour or var meter creeps or if the error in registration is more than 2% fast (average error as defined in section PSC 113.48), if the demand meter tested is more than 1.5% fast in excess of the tolerance allowed in section PSC 113.41, or if improper connections or auxiliary equipment results in over-registration greater than stated above. The fees for making such tests shall be as follows:

Direct current or single phase	
Self-contained	
12 kv.-a. or below -----	\$2
Over 12 kv.-a. -----	\$8
Polyphase meters	
Self-contained	
12 kv.-a. or below -----	\$6
Over 12 kv.-a. -----	\$8
Instrument transformer	
For each transformer tested -----	\$4
Demand meters	
Same as watthour meter if meter is separate	
For demand attachment -----	\$5

History: 1-2-56; (4) (e) r. and recr., Register, December, 1957, No. 24, eff. 1-1-58.

PSC 113.47 Methods of test. (1) In all tests of watthour meters where comparison of revolutions is made, at least two revolutions of the meter under test shall be taken at light load and at least nine revolutions at heavy load. At least two checks shall be made at each load. The accuracy of the meter under test at each load shall be the average accuracy determined from two checks taken at the same load which must agree within 0.2 of 1% unless the meter is erratic. However, if a mechanical testing device is used, the test procedure may be modified provided equal accuracy of method is maintained.

(2) If the watthour meter has a contact device which operates a demand mechanism, the disk revolutions when testing should be multiples of the number of revolutions per contact in order to take account of the varying friction which may be present during the movement of the contact cam from one contact to the next.

(3) Polyphase meters shall be tested by one of the following three methods:

(a) Single-phase test with voltage coils in parallel, current coils in series.

(b) Individual element test with voltage coils all simultaneously energized from the same or different phases. The current shall be of such magnitude that heavy load test current on each element will be between one-half and one N times the rated current of the meter but not more than twice the rated current and light load current shall be one-tenth N times the rated current of the meter. (N equals the number of elements in the polyphase watthour meter.) The average of the registration for each element shall be taken as the meter registration at heavy or light load, respectively.

(c) Polyphase test with a polyphase portable standard watthour meter. The resistance or phantom load used with the polyphase portable standard watthour meter may be either of the open delta or star connected type.

(d) The opposition method of testing for balance is satisfactory for adjusting purposes only and then only if properly made to avoid error due to anticreep holes in disk. It must be made with at least full-load current through the meter. The opposition check must be followed up with an individual element test according to method (b) above to ascertain the registration of each element, where such registration must be obtained. Means for obtaining 50% lagging power factor shall be provided for whichever method used.

(4) Instrument transformers shall be tested with a burden equivalent to that with which they are to be used or with burdens from which curves showing the accuracy of the transformer can be derived. Any approved method may be used for testing instrument transformers.

PSC 113.48 Determination of average meter error. Whenever a metering installation is found upon any test to be in error by more than 2% at any test load, the average error shall be determined in one of the following ways:

(1) If the metering installation is used to measure a load which has practically constant characteristics, such as a street-lighting load, the meter shall be tested under similar conditions of load and the accuracy of the meter "as found" shall be considered as the average accuracy.

(2) If a single-phase or direct-current metering installation is used on a varying load, the average error shall be the weighted algebraic average of the error at light load and the error at heavy load, the latter being given a weighting of 4 times the former.

(3) If a polyphase metering installation is used on a varying load, the average error shall be the weighted algebraic average of its error at light load given a weighting of 1, its error at heavy load and 100% power factor given a weighting of 4, and at heavy load and 50% lagging power factor given a weighting of 2.