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COMPANY NAME: PORTLAND GENERAL ELECTRIC COMPANY

DOES REPORT CONTAIN CONFIDENTIAL INFORMATION? No Yes If yes, submit a redacted public version (or a cover letter) by email. Submit the confidential information as directed in OAR 860-001-0070 or the terms of an applicable protective order.

Select report type: RE (Electric) RG (Gas) RW (Water) RT (Telecommunications)
 RO (Other, for example, industry safety information)

Did you previously file a similar report? No Yes, report docket number: RE 93

Report is required by: OAR 860-023-0015

Statute

Order

Note: A one-time submission required by an order is a compliance filing and not a report (file compliance in the applicable docket)

Other

(For example, federal regulations, or requested by Staff)

Is this report associated with a specific docket/case? No Yes, docket number: UM 1384

List Key Words for this report. We use these to improve search results.

PGE's Revision to Meter Test and Inspection Policy

Send the completed Cover Sheet and the Report in an email addressed to PUC.FilingCenter@state.or.us

Send confidential information, voluminous reports, or energy utility Results of Operations Reports to PUC Filing Center, PO Box 1088, Salem, OR 97308-1088 or by delivery service to 201 High Street SE Suite 100, Salem, OR 97301.

UM 1384 PGE's Revision to
Meter Test and Inspection Policy

Attachment A

Acceptance Testing



Purpose

The purpose of this document is to outline the acceptance testing procedures for accepting or rejecting a lot.

Required Steps

The following steps will be performed when installing/exchanging a meter/equipment:

- Determine lot size
- Determine sample size
- Perform accuracy test on sample size
- Accept or reject lot based on failures
- If needed, perform second acceptance testing

Procedures

The following is based on ANSI Z1.4, General Inspection Level II, Acceptance Quality Limit (AQL) of 2.5, and Double Sampling Plan.

Lot Size

Determine the meter lot size. Once lot size has been determined look at Table 1 to determine the sample size.

Sample Size

The sample size is the number of meters tested. This is determined by the lot size. This can be found in Table 1.

Accept or Reject Lot

A lot is accepted if the number of failures is less than or equal to the number in the Accept column under First Sample, in Table 1, according to the lot size.

A lot is rejected if the number of failures is greater than or equal to the number in the Reject column under First Sample, in Table 1, according to the lot size.

If the number of failures is in between the number in the Accept and Reject columns under First Sample, in Table 1, a double sampling is required on the same lot.

Double Sampling

A second sample of the same size, picked from the same lot, if the number of failures is in between the number in the Accept and Reject column under First Sample, in Table 1.

A lot is accepted if the number of failures is less than or equal to the number in the Accept column under Second Sample, in Table 1.

A lot is rejected if the number of failures is greater than or equal to the number in the Reject column under Second Sample, Table 1.

Failure Conditions

A meter is deemed to be a failure if one of the following conditions are met:

- Tested accuracy is outside acceptable PGE tolerance limits
- Factory metrology configuration does not match PGE specification
- Broken or defective hardware, such as, but not limited to:
 - Display not functional
 - Remote connect is inoperable
 - Communication module is inoperable
 - Misaligned jaw(s)

Note: Communication module configuration is not considered a failure condition. Any differences should be identified and provided to Meter Standards.



Meter Shop: Acceptance Testing

09-19-2019

MSFO Procedure

Doc ID: 3.8.4

Table 1: Double Sampling Plan Summary

Lot Size	First and Second Sample Size	First Sample		Second Sample	
		Accept (if total # \leq)	Reject (if total # \geq)	Accept (if total # \leq)	Reject (if total # \geq)
2 to 8	2	0	1	0	1
9 to 15	2	0	1	0	1
16 to 25	3	0	1	0	1
26 to 50	5	0	1	0	1
51 to 90	8	0	2	1	2
91 to 150	13	0	2	1	2
151 to 280	20	0	3	3	4
281 to 500	32	1	4	4	5
501 to 1200	50	2	5	6	7
1201 to 3200	80	3	7	8	9
3201 to 10000	125	5	9	12	13



Meter Shop: Acceptance Testing

09-19-2019

MSFO Procedure

Doc ID: 3.8.4

Revision History

Revision	Revision Date	Revision Description	Authored by	Approved by
0	09/17/19	Initial document creation	S. Keams, J. Wilson	B. Simpson

PORTLAND GENERAL ELECTRIC METER TEST AND INSPECTION POLICY

PROCEDURES FOR MAINTAINING THE ACCURACY OF PORTLAND GENERAL ELECTRIC STANDARDS, METERS, AND METERING SYSTEMS

Previous Revision – February 5, 2014

Revision – April 1, 2020

1. Scope

This document outlines the procedural requirements of Portland General Electric's (PGE or Company) scheduled electric metering test and verification programs. This policy is submitted to satisfy OAR 860-023-0015 as required by the Oregon Public Utility Commission (OPUC or Commission).

PGE deployment of solid-state Advanced Metering Infrastructure (AMI) meters occurred between 2008 and 2010 to replace in-service electromechanical meters. AMI meters allow for automated collection of meter data through a fixed two-way communication network. Adjustments to policy were made post-deployment for increased monitoring and verification purposes to ensure meter accuracies remained within acceptable tolerances.

This policy revision aligns with current industry testing methods and practices while ensuring system validation through statistical analysis.

2. General

The intent of PGE's metering policies, procedures, and practices is to properly apply, install and maintain meters and metering devices to ensure the accuracy of customer metering. No meter or metering device shall be placed in service, or allowed to remain in service, that has an incorrect watt-hour constant, that is mechanically or electrically defective, incorrectly connected, installed, or applied, or that is outside acceptable accuracy tolerances. No device shall be placed on or in a meter or metering system that could adversely affect the accuracy or performance of the meter or metering system.

PGE standards, practices and procedures for maintaining the accuracy of electric meters and metering systems are based on accepted national metering and quality standards and are maintained in compliance with applicable regulatory requirements and rules.

PGE has established practices and programs for continuing surveillance of its metering systems and customer service facilities to determine and take appropriate action

concerning hazards, failures and defects associated with metering systems and customer service facilities.

All PGE employees and contractors who perform work associated with customer metering systems shall be trained and be alert in the normal course of their daily work to identify and report safety, security, revenue and other metering defect issues.

3. References

This document references the following industry and PGE standards:

- PGE Meter Services shall communicate and implement metering policies, standards and procedures internal to the company and to applicable contractors.
- ORS 757.250 and OAR 860-023-0015 shall be used as minimum legal standards for metering system compliance.
- ANSI C12.1-2014 Code for Electricity Metering shall be used as a minimum maintenance standard for accuracy performance for standardizing equipment and in-service tests and metering devices.
- ANSI/ASQ Z1.4-2003 (R2013) Sampling Procedures and Tables for Inspection by Attributes shall be used as a minimum for meter acceptance testing.
- ANSI/ASQ Z1.9-2003 (R2013) Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming shall be used as a minimum standard for in-service meter sample testing.
- PGE Electric Service Requirements is used as standard for new metering and service installations.
- Public Utility Commission of Oregon Order No. 08-245 in UE 189.

4. Definitions

- (a) AMI Meter – a solid-state electronic meter which provides for two-way communications to allow the automated collection of metering data and for sending signals to the meter.
- (b) Company – Portland General Electric
- (c) Defective Meter Group – An identified homogeneous group of meters, or distinct subdivision thereof, that exceeds acceptable percent nonconforming, as defined in ANSI/ASQ Z1.9-2003 (R2013).
- (d) Homogeneous Meter Group (HMG) – A group of meters produced by the same manufacturer, having related type designation, of the same design and the same relationship of parts.
- (e) Metering System – The entire metering circuit and installation including all sensing, measuring, totalizing, registering and communication devices as well as enclosures, instrument transformers, wiring and communication links.
- (f) NIST – National Institute of Standards and Technology, under US Dept. of Commerce.
- (g) Periodic Meter Group (PMG) – A group of metering systems tested, inspected, and verified in a specific year that are on the same test frequency in a Periodic Meter Test Program.

- (h) Periodic Meter Test Program – An established scheduled pattern of meter testing and site verification where each site will be selected according to a designated regular time-interval.
- (i) Sample Meter Test Program – An established random pattern of testing meters belonging to a HMG whereby each meter has an equal opportunity to be selected for testing each year.
- (j) Uniquely Defective Meter – A meter selected for random sampling with unusable test results, including meters with broken covers, missing test data, accuracy performance characteristics greater than $\pm 5\%$ resulting from unique physical experience or unique electrical experience, and is not representative of other in-service meters in its HMG.

5. Watt-hour Standards and Standardizing Equipment

- (a) PURPOSE:
To ensure watt-hour measurement equipment used to test accuracy of billing meters is calibrated and traceable to National Institute of Standards Technology (NIST).
- (b) RESPONSIBILITY:
The company maintains a Standards Laboratory that is responsible for certification of all portable watt-hour standards used within PGE. The Standard Laboratory is available at all times, by appointment, during business hours for inspection or use by Commission's representatives.
- (c) SUMMARY OF METHOD:
The company uses a reference watt-hour standard to compare all other watt-hour standards to ensure revenue meter accuracy. The calibration accuracy of the reference standard is verified at six-month intervals to Standard Instruments and are traceable to NIST. If the accuracy of the reference standard is outside acceptable tolerances as defined by ANSI C12.1-2014 Section 3, the Company shall calibrate the standard to acceptable limits, if possible. The reference watt-hour standard is stored and used in a temperature and humidity-controlled environment.

The reference watt-hour standard is used to certify portable watt-hour standards at intervals not to exceed six-months. Certifications are performed by PGE's Instrument Laboratory using a comparison method with a secondary watt-hour standard.

Documentation for all calibrations and for calibration procedures and results for each reference standard, portable watt-hour standard, and portable secondary watt-hour standard is maintained in a database system and should be kept for at least five years. A calibrated certification tag is affixed to each watt-hour standard. Each certification tag contains the calibration date, calibration result, next calibration due date, and the calibrating technician initials. Calibrations are performed following the guidance of ANSI C12.1-2014, ANSI code for Electric Metering.

6. Meter Quality Assurance

(a) PURPOSE:

To assure meters meet Company accuracy requirements before acceptance or installation in accordance to ANSI C12.1-2014.

(b) RESPONSIBILITY:

The meter manufacturer shall test all new single-phase and three-phase meters before being shipped to the company. The manufacturer shall provide certified test data for all new meters to the company. The Company is responsible for analysis of meter manufacturers test data to ensure accuracy specifications are met. The Company shall provide copies of its analysis of the manufacturers test data to the Commission its next Annual Certification Report. If the Company purchased used solid-state meters, the Company is responsible for testing all the purchased meters. The Company is responsible for keeping meter test records in accordance with Section 13 of this policy.

(c) SAMPLING METHOD:

Sample testing of new meters is accomplished by selecting samples based on shipment size as defined in ANSI/ASQ Z1.4-2003 (R2013) with a General Inspection Level II, Acceptance Quality Limit (AQL) of 2.5, and Double Sampling Plan. Accuracy testing is performed based on ANSI C12.20-2015, Company accuracy tolerance specifications, and includes functionality testing of AMI communication modules. If number of failed accuracy tests is less than limit defined in ANSI/ASQ Z1.4-2003 (R2013), shipment is accepted. See Appendices for detailed acceptance testing policy.

The company requires accuracy for new meters at light and full loads to be within $\pm 0.3\%$ for solid-state electronic meters. Any sample test lot found to be outside acceptable accuracy limits would be held from service until repaired or replaced. . Weighted percent registration is defined by ANSI C12.1-2014, Section 5.1.4.1, Method 1.

(d) Meter Manufacturer Assessment

The Company will perform a quality assessment on each watt-hour meter supplier at intervals not to exceed five years.

7. In-Service Random Sample Meter Testing

(a) PURPOSE:

The purpose of this test program is to detect inaccurate meter groups and yield statistical information on which to base future maintenance and testing.

The in-service testing program includes watt-hour meters of the following types:

- Self-contained single phase and three phase revenue meters.

- Instrument transformer rated revenue meters.

(b) RESPONSIBILITY:

The Company shall report on the results of its in-service random sample meter testing in its Annual Certification Report. The Company is responsible for keeping these results for at least ten years.

(c) METHOD:

Random sample of meters are selected annually from each applicable Homogeneous Meter Group (HMG) using the company meter asset database and placed into sample lots. Sample lots are created and tested in the following manner:

Meters are grouped by equipment type, manufacturer, and model having the same design and relationship of parts. For large HMGs over 150,000 meters, subgroups no larger than 100,000 meters are created.

Group sample sizes are based on ANSI/ASQ Z1.9-2003 (R2013) with a General Inspection Level II, Acceptance Quality Limit (AQL) of 2.5, and Double Specification Limit. Maximum Allowable Percent Defective for each meter sample lot is determined from ANSI/ASQ Z1.9, Table B-3.

The test results of uniquely defective meters are excluded from statistical analysis only if the cause of the error can be attributed to external causes or outside forces (e.g., vandalism, tampering, lightning, corrosive environment, etc.).

(d) TEST RESULTS ANALYSIS:

Sample plan test results are analyzed based on ANSI/ASQ Z1.9-2003 (R2013). If Estimated Lot Percent Defective exceeds Maximum Allowable Percent Defective for two consecutive years the lot is considered to be a “failed” lot. Meters within a failed lot will be retired within four years.

The company shall evaluate uniquely defective meters identified within each HMG. Condition codes are assigned to uniquely defective meters based on initial condition of meter installation.

8. In-Service Periodic Meter Testing

(a) PURPOSE:

The purpose of this testing and verification program is to identify and correct inaccurate and defective metering systems. Additionally, this program is to detect inaccurate meter groups and yield statistical information on which to base future maintenance and testing.

This in-service program includes revenue meters that are for services with an average load 1MW and greater.

(b) **RESPONSIBILITY:**

The Company shall provide the results of its in-service periodic meter testing in its Annual Certification Report. The Company is responsible for keeping these results for at least ten years.

(c) **METHOD:**

Large Commercial/Industrial customers served by substation metering will receive biennial meter testing and inspection. Commercial/Industrial customers that have an average load greater than 1MW will receive biennial meter testing and inspection. Meter lots will be divided into groups based on company equipment type and manufacturer.

A meter is defined as acceptable if as-found average accuracy is within 100 ± 0.3 percent registration. Weighted percent registration is defined by ANSI C12.1-2014, Method 1.

All meters with an error greater than ± 0.3 % in as-found testing are removed from service. All meters with an error greater than $+ 5$ % in as-found testing are declared uniquely defective and removed from service. The test results of uniquely defective meters are excluded from statistical analysis only if the cause of error is attributed to external causes or outside forces (e.g., vandalism, tampering, lightning, corrosive environment, etc.).

9. **Instrument Transformers**

(a) **PURPOSE:**

To ensure that metering transformers are accurate in accordance to ANSI C12.1-2014 and IEEE C57.13-2016.

(b) **RESPONSIBILITY:**

The Company is responsible for ensuring current and voltage transformers used for revenue metering are accurate and within acceptable accuracy tolerance limits. The Company is responsible to validate manufacturer test results.

(c) **SUMMARY OF METHOD:**

The Company requires all metering current and voltage transformers be tested by the manufacturer. The manufacturer will provide the company with certified test results that verify voltage withstand, ratio correction factor, and phase angle tests were performed. All current and voltage transformers utilized for revenue metering will have an in-service test and validation performed within 90 days of installation.

(d) **TESTING:**

Pre-installation tests are performed by the manufacturer in accordance with ANSI C12.1-2014 section 5.2.1. Metering current and voltage transformers are rated at 0.3 % accuracy or better.

Field Testing/Verification complies with ANSI C12.1-2014 section 5.2.3 and section 5.2.4. All instrument transformers, both new and returned from service, will have a field test/verification performed within 90 days of installation. The following tests/verifications are performed after meter installation is in-service:

- ANSI C12.1-2014: 5.2.3.1---Burden Test
- ANSI C12.1-2014: 5.2.3.2---Secondary Voltage Test
- ANSI C12.1-2014: 5.2.4-----Inspection

(e) Instrument Transformer Manufacturer Assessment

The Company will perform a quality assessment on each instrument transformer supplier at intervals not to exceed five years.

10. Testing and Verification Methods

(a) RESPONSIBILITY:

The company is responsible for operating, maintaining, and revising metering test and verification program. Tests and verifications are performed by the company or approved contractor for the company.

(b) TESTING:

Watt-hour tests are performed at 100 percent of nameplate test current (FL) and 10 percent of nameplate test current (LL) in accordance with ANSI C12.1-2014.

A meter is defined as acceptable if as-found average accuracy is within 100 ± 0.3 percent registration. Weighted percent registration is defined by ANSI C12.1-2014, Method 1.

(c) CALIBRATION:

Electronic meters are not calibrated.

(d) VERIFICATION OF METERING SYSTEMS:

Meter system verifications are performed on all metering installations when tested; this includes periodic and sample tests along with new, transformer service installations 90 days after the service was energized. The purpose of the verification is to assure the correctness of the meter installation and associated records, it will include the following when applicable:

- A. Meter accuracy testing
- B. Demand register testing
- C. Correctness of meter application
- D. Meter loading
- E. Correctness of billing multiplier
- F. Correctness of wiring
- G. Condition of wiring
- H. Current transformer sizing
- I. Quality and ratio of instrument transformers (verify nameplate data)
- J. Current transformer burden tests
- K. Voltage measurements
- L. Current measurements
- M. Phase angle test
- N. Instantaneous power factor measurements
- O. Security of the metering system and components
- P. Accessibility of the meter and other metering devices
- Q. Safety of the metering system and site
- R. Safety and condition of the electric distribution system
- S. Current diversion
- T. Revenue implications (i.e., customer under-billing or over-billing)

11. Security and Revenue Protection

PGE will maintain documented procedures to ensure and verify the physical security and safety of metering installations through training of personal, control of sealing and locking devices, and installation of seals and locking devices for meter system security and integrity. Additional controls will be used for meter information technology security. Password protections will be maintained for programmable meters to prevent unauthorized adjustment, programming or data acquisition.

Revenue validation and protection programs will include training of field and billing personnel and high/low energy usage audits designed to trigger consumption investigations. Qualified personnel are assigned the responsibility to investigate field conditions that may have loss of revenue implications.

12. Electric Service Requirements

Specific applications of the Electric Utility Service Equipment Requirements Committee (EUSERC) manual are described in the company Electric Service Requirements, available at: PortlandGeneral.com/ESR.

13. Record Keeping

Records are maintained for all laboratory and field test standards by serial number. Records for standards are maintained for the life of the equipment plus five years. Test records are maintained for all meters and auxiliary transformers for the life of the

equipment plus one year. All energy diversion investigations are recorded and records are maintained for five years.

The record of the most recent accuracy test of each instrument transformer is maintained for at least as long as the instrument transformer is in service plus three years. The record of each instrument transformers includes the manufacturer's name or trademark, type, and serial number. Each instrument transformer placed in service will be marked with the same information.

The record of the most recent accuracy test of each watt-hour meter is maintained for at least as long as the instrument transformer is in service plus three years. Accuracy record of each watt-hour meter includes the following:

- A. Date of test;
- B. Reason for test;
- C. Reading and accuracy of meter as found and as left;
- D. Identification of person who performed the test; and
- E. Identification of equipment used to test meter.

The record of each watt-hour meter includes the following:

- F. Manufacturer and date of purchase, along with any testing data provided by the manufacturer that is used by the entity for acceptance testing of the meter;
- G. Manufacturer or Company's identification number;
- H. Date and place of present or most recent installation
- I. Date and type of last major repair, or of final disposition;
- J. Nameplate data, which includes:
 - i. Form designation or circuit description;
 - ii. "Watt-hour meter" or other description;
 - iii. Manufacturer's name or trademark;
 - iv. Manufacturer's type;
 - v. Electrical current class;
 - vi. Rated voltage;
 - vii. Number of wires;
 - viii. Frequency;
 - ix. Test amperes;
 - x. Watt-hour meter constant; and
 - xi. Watt-hour meter test constant (if applicable).

14. Meter Tests Requested by Customers

If a customer requested that a meter that serves their account be tested for accuracy, the Company shall test the customer's meter, in accordance with OAR 860-021-0130.

15. Treatment of Inaccurate Metering Data

Upon discovery that a meter serving a customer is outside acceptable OPUC limits as defined in OAR 860-021-0130, the Company shall correct the metering error. The Company shall direct its billing department to adjust customer bills according to the corrected metering data and reimburse customer for all overcharges as defined in OAR 860-021-0135.

16. Annual Metering Management Review

PGE will annually evaluate the currency of its metering policies, practices and procedures with updated national and state regulations, standards and guidelines. PGE will maintain a documented management review program to ensure compliance with OPUC regulations and established company policies and directives.

17. Annual Report and Certification to OPUC

Meter Services will submit an annual certification report to the Commission as set out in Section S of the OPUC's Electric utility Metering Policy. Included in the report are:

- A. Company's analysis of newly purchased watt-hour meter accuracy tests provided by the manufacturers
- B. Meter group descriptions
- C. Number of meters in the group
- D. Number of meters tested per group
- E. Mean of the as-found Average Accuracy for each group
- F. Standard deviation of the as-found Average Accuracy for each group
- G. High/low range of the as-found Average Accuracy for each group
- H. Percentage above/below 100 + 2 % Average Accuracy for each group
- I. Number of meters uniquely defective per HMG group listed by cause and analysis of defects
- J. Company's analysis of in-service periodic meter testing
- K. Proposed action for future testing and maintenance based on test results
- L. Meter Audit failures listed by cause and analysis of defects for PMG's
- M. Nonconformance Revenue Implications
- N. The number of qualified personnel employed by PGE
- O. Executive Summary of Annual Metering Management Review



Portland General Electric
121 SW Salmon Street · Portland, Ore. 97204

March 13, 2020

Public Utility Commission of Oregon
Attn: Filing Center
201 High Street, S.E.
P.O. Box 1088
Salem, OR 97308-1088

RE: UM 1384 PGE's Revision to Meter Test and Inspection Policy

Portland General Electric Company (PGE) hereby submits for Commission approval, PGE's revised Meter Test and Inspection Policy. The Meter Test and Inspection Policy are used as minimum legal standards for metering system compliance under the following authorities; Oregon Revised Statute (ORS) 757.250, Oregon Administrative Rule (OAR) 860-023-0015, and ANSI C12.1-2014 Code for Electricity Metering.

On November 27, 2019, PGE submitted a revised Meter Test and Inspection Policy. The proposed revisions to PGE's Meter Test and Inspection Policy align with industry practices and standards and most are housekeeping in nature. Staff provided comments on PGE's Meter Test and Inspection Policy filing and on March 5, 2020 PGE and Staff met to discuss the changes requested by Staff.

As a result of those discussions, PGE is filing the revised Meter Test and Inspection Policy including a redline version for added convenience. Also, PGE's Acceptance Testing of PGE's Meter Test and Inspection Policy as Attachment A. PGE requests that this Policy be approved at the March 31, 2020 public meeting and effective April 1, 2020.

Please direct any questions or comments regarding this report, to Mary Widman at (503) 464-8223.

Please direct all formal correspondence and requests to the following email address: pge.opuc.filings@pgn.com.

Sincerely,

A handwritten signature in blue ink that reads "Robert Macfarlane". The signature is written in a cursive, flowing style.

Robert Macfarlane
Manager, Pricing & Tariffs

Enclosures

UM 1384 PGE's Revision to
Meter Test and Inspection Policy
Redline version

PORTLAND GENERAL ELECTRIC METER TEST AND INSPECTION POLICY

PROCEDURES FOR MAINTAINING THE ACCURACY OF PORTLAND GENERAL ELECTRIC STANDARDS, METERS, AND METERING SYSTEMS

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This policy revision incorporates changes reflecting PGE's OPUC-approved Advanced Metering Infrastructure (AMI) deployment program which installed new solid-state electronic meters all of which have been tested by the manufacturer prior to shipment and a fixed two-way communications system that allows the automated collection of metering data and for sending signals to the meter. ¶

¶ All (100%) AMI meters have been tested by the manufacturer prior to shipment, and approximately 3% were additionally tested by the Company prior to deployment and installation. The installation of AMI meters began in 2008 and concluded at the end of 2010.¶

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Commented [RY6]: Does the Company have var-hour meters in service?

Commented [JW7R6]: "Watt-hour constant" refers to programming constant on meter that defines pulsing and recording frequency.

Official definition, per ANSI C12.1-2014: The expression of the relationship between the energy applied to the watt-hour meter and the corresponding occurrence of one test output indication expressed as watt-hours per test output indication.

Meters are programmed to record various quantities based on applicable rate schedules, e.g. watt-hour, var-hour.

Commented [RY8]: Please define "metering circuit."

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Commented [RY9]: Are those programs included in this policy? Are those programs approved or acknowledged by PUC?

concerning hazards, failures and defects associated with metering systems and customer service facilities.

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Commented [RY10]: Are PGE electric service requirements approved or acknowledged by the Commission?

Commented [JW11R10]: Good question. Not to my knowledge. Does the commission oversee PacifiCorp Electric Service Requirements?

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- (h) Periodic Meter Test Program – An established scheduled pattern of meter testing and site verification where each site will be selected according to a designated regular time-interval.
- (i) Sample Meter Test Program – An established random pattern of testing meters belonging to a HMG whereby each meter has an equal opportunity to be selected for testing each year.
- (j) Uniquely Defective Meter – A meter selected for random sampling with unusable test results, including meters with broken covers, missing test data, accuracy performance characteristics greater than $\pm 5\%$ resulting from unique physical experience or unique electrical experience, and is not representative of other in-service meters in its HMG.

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5. Watt-hour Standards and Standardizing Equipment

(a) **PURPOSE:**
To ensure watt-hour measurement equipment used to test accuracy of billing meters is calibrated and traceable to National Institute of Standards Technology (NIST).

(b) **RESPONSIBILITY:**
The company maintains a Standards Laboratory that is responsible for certification of all portable watt-hour standards used within PGE. The Standard Laboratory is available at all times, by appointment, during business hours for inspection or use by Commission’s representatives.

Deleted: RESPONSIBILITY

Commented [JW14]: Is there a need for Commission to use PGE instrument lab?

(c) **SUMMARY OF METHOD:**
The company uses a reference watt-hour standard to compare all other watt-hour standards to ensure revenue meter accuracy. The calibration accuracy of the reference standard is verified at six-month intervals to Standard Instruments and are traceable to NIST. If the accuracy of the reference standard is outside acceptable tolerances as defined by ANSI C12.1-2014 Section 3, the Company shall calibrate the standard to acceptable limits, if possible. The reference watt-hour standard is stored and used in a temperature and humidity-controlled environment.

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The reference watt-hour standard is used to certify portable watt-hour standards at intervals not to exceed six-months. Certifications are performed by PGE’s Instrument Laboratory using a comparison method with a secondary watt-hour standard.

Moved up [1]: The reference watt-hour standard is stored and used in a temperature and humidity-controlled environment.

Deleted: Portable secondary watt-hour standards are certified at sixthree-month intervals by PGE’s Instrument Laboratory. Certification is accomplished using a comparison method with a secondary watt-hour standard. ¶

Documentation for all calibrations and for calibration procedures and results for each reference standard, portable watt-hour standard, and portable secondary watt-hour standard is maintained in a database system and should be kept for at least five years. A calibrated certification tag is affixed to each watt-hour standard. Each certification tag contains the calibration date, calibration result, next calibration due date, and the calibrating technician initials. Calibrations are performed following the guidance of ANSI C12.1-2014, ANSI code for Electric Metering.

6. Meter Quality Assurance

(a) PURPOSE:

To assure meters meet Company accuracy requirements before acceptance or installation in accordance to ANSI C12.1-2014.

(b) RESPONSIBILITY:

The meter manufacturer shall test all new single-phase and three-phase meters before being shipped to the company. The manufacturer shall provide certified test data for all new meters to the company. The Company is responsible for analysis of meter manufacturers test data to ensure accuracy specifications are met. The Company shall provide copies of its analysis of the manufacturers test data to the Commission its next Annual Certification Report. If the Company purchased used solid-state meters, the Company is responsible for testing all the purchased meters. The Company is responsible for keeping meter test records in accordance with Section 13 of this policy.

Deleted: RESPONSIBILITY

Commented [RY17]: Does PGE keep records of that analysis?

Commented [JW18R17]: Manufacturer test records are stored in PGE meter asset database, PowerTrack.

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(c) SAMPLING METHOD:

Sample testing of new meters is accomplished by selecting samples based on shipment size as defined in ANSI/ASQ Z1.4-2003 (R2013) with a General Inspection Level II, Acceptance Quality Limit (AQL) of 2.5, and Double Sampling Plan. Accuracy testing is performed based on ANSI C12.20-2015, Company accuracy tolerance specifications, and includes functionality testing of AMI communication modules. If number of failed accuracy tests is less than limit defined in ANSI/ASQ Z1.4-2003 (R2013), shipment is accepted. See Appendices for detailed acceptance testing policy.

Commented [RY19]: Are company accuracy tolerance specifications outlined in this policy? ($\pm 0.3\%$ LL and FL?)

Commented [JW20R19]: PGE requires accuracy for new meters at light and full loads to be within $\pm 0.3\%$ for solid-state electronic meters

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The company requires accuracy for new meters at light and full loads to be within $\pm 0.3\%$ for solid-state electronic meters. Any sample test lot found to be outside acceptable accuracy limits would be held from service until repaired or replaced. Weighted percent registration is defined by ANSI C12.1-2014, Section 5.1.4.1, Method 1.

Commented [RY21]: Are the appendices attached to this policy?

Commented [JW22R21]: Acceptance testing procedure should be attached and is identified as: PGE Meter Services & Field Operations (MSFO) document ID: 3.8.4

Commented [RY23]: When testing for meter accuracy, does the Company consider the power factor?

Commented [JW24R23]: Average percentage registration is calculated using Full Load (FL) and Light Load (LL), as defined in ANSI C12.1-2014 Section 5.1.4.1 Method 1.

(d) Meter Manufacturer Assessment

The Company will perform a quality assessment on each watt-hour meter supplier at intervals not to exceed five years.

Commented [RY25]: Does PGE use the same formula for both single phase and polyphase watt-hour meters?

Commented [JW26R25]: Yes.

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7. In-Service Random Sample Meter Testing

(a) PURPOSE:

The purpose of this test program is to detect inaccurate meter groups and yield statistical information on which to base future maintenance and testing.

The in-service testing program includes watt-hour meters of the following types:

- Self-contained single phase and three phase revenue meters.

- Instrument transformer rated revenue meters.

(b) RESPONSIBILITY:

The Company shall report on the results of its in-service random sample meter testing in its Annual Certification Report. The Company is responsible for keeping these results for at least ten years.

(c) METHOD:

Random sample of meters are selected annually from each applicable Homogeneous Meter Group (HMG) using the company meter asset database and placed into sample lots. Sample lots are created and tested in the following manner:

Meters are grouped by equipment type, manufacturer, and model having the same design and relationship of parts. For large HMGs over 150,000 meters, subgroups no larger than 100,000 meters are created.

Group sample sizes are based on ANSI/ASQ Z1.9-2003 (R2013) with a General Inspection Level II, Acceptance Quality Limit (AQL) of 2.5, and Double Specification Limit. Maximum Allowable Percent Defective for each meter sample lot is determined from ANSI/ASQ Z1.9, Table B-3.

The test results of uniquely defective meters are excluded from statistical analysis only if the cause of the error can be attributed to external causes or outside forces (e.g., vandalism, tampering, lightning, corrosive environment, etc.).

(d) TEST RESULTS ANALYSIS:

Sample plan test results are analyzed based on ANSI/ASQ Z1.9-2003 (R2013). If Estimated Lot Percent Defective exceeds Maximum Allowable Percent Defective for two consecutive years the lot is considered to be a "failed" lot. Meters within a failed lot will be retired within four years.

The company shall evaluate uniquely defective meters identified within each HMG. Condition codes are assigned to uniquely defective meters based on initial condition of meter installation.

8. In-Service Periodic Meter Testing

(a) PURPOSE:

The purpose of this testing and verification program is to identify and correct inaccurate and defective metering systems. Additionally, this program is to detect inaccurate meter groups and yield statistical information on which to base future maintenance and testing.

This in-service program includes revenue meters that are for services with an average load 1MW and greater.

(b) RESPONSIBILITY:

The Company shall provide the results of its in-service periodic meter testing in its Annual Certification Report. The Company is responsible for keeping these results for at least ten years.

(c) METHOD:

Large Commercial/Industrial customers served by substation metering will receive biennial meter testing and inspection. Commercial/Industrial customers that have an average load greater than 1MW will receive biennial meter testing and inspection. Meter lots will be divided into groups based on company equipment type and manufacturer.

A meter is defined as acceptable if as-found average accuracy is within 100 ± 0.3 percent registration. Weighted percent registration is defined by ANSI C12.1-2014, Method 1.

All meters with an error greater than ± 0.3% in as-found testing are removed from service. All meters with an error greater than + 5% in as-found testing are declared uniquely defective and removed from service. The test results of uniquely defective meters are excluded from statistical analysis only if the cause of error is attributed to external causes or outside forces (e.g., vandalism, tampering, lightning, corrosive environment, etc.).

9. Instrument Transformers

(a) PURPOSE:

To ensure that metering transformers are accurate in accordance to ANSI C12.1-2014 and IEEE C57.13-2016.

(b) RESPONSIBILITY:

The Company is responsible for ensuring current and voltage transformers used for revenue metering are accurate and within acceptable accuracy tolerance limits. The Company is responsible to validate manufacturer test results.

(c) SUMMARY OF METHOD:

The Company requires all metering current and voltage transformers be tested by the manufacturer. The manufacturer will provide the company with certified test results that verify voltage withstand, ratio correction factor, and phase angle tests were performed. All current and voltage transformers utilized for revenue metering will have an in-service test and validation performed within 90 days of installation.

(d) TESTING:

Pre-installation tests are performed by the manufacturer in accordance with ANSI C12.1-2014 section 5.2.1. Metering current and voltage transformers are rated at 0.3% accuracy or better.

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Commented [RY27]: Does PGE use the same formula for both single phase and polyphase watt-hour meters?

Commented [JW28R27]: Yes.

Commented [RY29]: What is the difference in treatment between removing the meters with error greater than ±0.3% and those with error ±5%?

Commented [JW30R29]: An uniquely defective meter is a meter selected for random sampling with unusable test results, including meters with broken covers, missing test data, accuracy performance characteristics greater than ± 5% resulting from unique physical experience or unique electrical experience, and is not representative of other in-service meters in its HMG.

Uniquely defective meters are flagged in PGE's meter asset database as an attempt to identify manufacturing defects that lead to meter failures.

If a meter is outside acceptable PGE accuracy tolerances of ±0.3%, the meter will be removed from service, which includes ±5%.

Commented [RY31]: What year?

Commented [JW32R31]: IEEE C57.13-2016

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Commented [RY33]: What is the validation method?

Commented [JW34R33]: Manufacturer test records are received electronically and validated upon input into PGE meter asset database, PowerTrack.

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Field Testing/Verification complies with ANSI C12.1-2014 section 5.2.3 and section 5.2.4. All instrument transformers, both new and returned from service, will have a field test/verification performed within 90 days of installation. The following tests/verifications are performed after meter installation is in-service:

- ANSI C12.1-2014: 5.2.3.1---Burden Test
- ANSI C12.1-2014: 5.2.3.2---Secondary Voltage Test
- ANSI C12.1-2014: 5.2.4-----Inspection

- (e) Instrument Transformer Manufacturer Assessment
The Company will perform a quality assessment on each instrument transformer supplier at intervals not to exceed five years.

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10. Testing and Verification Methods

- (a) RESPONSIBILITY:
The company is responsible for operating, maintaining, and revising metering test and verification program. Tests and verifications are performed by the company or approved contractor for the company.
- (b) TESTING:
Watt-hour tests are performed at 100 percent of nameplate test current (FL) and 10 percent of nameplate test current (LL) in accordance with ANSI C12.1-2014.
- A meter is defined as acceptable if as-found average accuracy is within 100 ± 0.3 percent registration. Weighted percent registration is defined by ANSI C12.1-2014, Method 1.
- (c) CALIBRATION:
Electronic meters are not calibrated.
- (d) VERIFICATION OF METERING SYSTEMS:
Meter system verifications are performed on all metering installations when tested; this includes periodic and sample tests along with new, transformer service installations 90 days after the service was energized. The purpose of the verification is to assure the correctness of the meter installation and associated records, it will include the following when applicable:

- A. Meter accuracy testing
- B. Demand register testing
- C. Correctness of meter application
- D. Meter loading
- E. Correctness of billing multiplier
- F. Correctness of wiring
- G. Condition of wiring
- H. Current transformer sizing
- I. Quality and ratio of instrument transformers (verify nameplate data)
- J. Current transformer burden tests
- K. Voltage measurements
- L. Current measurements
- M. Phase angle test
- N. Instantaneous power factor measurements
- O. Security of the metering system and components
- P. Accessibility of the meter and other metering devices
- Q. Safety of the metering system and site
- R. Safety and condition of the electric distribution system
- S. Current diversion
- T. Revenue implications (i.e., customer under-billing or over-billing)

11. Security and Revenue Protection

PGE will maintain documented procedures to ensure and verify the physical security and safety of metering installations through training of personnel, control of sealing and locking devices, and installation of seals and locking devices for meter system security and integrity. Additional controls will be used for meter information technology security. Password protections will be maintained for programmable meters to prevent unauthorized adjustment, programming or data acquisition.

Revenue validation and protection programs will include training of field and billing personnel and high/low energy usage audits designed to trigger consumption investigations. Qualified personnel are assigned the responsibility to investigate field conditions that may have loss of revenue implications.

12. Electric Service Requirements

Specific applications of the Electric Utility Service Equipment Requirements Committee (EUSERC) manual are described in the company Electric Service Requirements, available at: PortlandGeneral.com/ESR.

13. Record Keeping

Records are maintained for all laboratory and field test standards by serial number. Records for standards are maintained for the life of the equipment plus five years. Test records are maintained for all meters and auxiliary transformers for the life of the

Commented [RY35]: Are these procedures and controls already implemented? Do these procedures include measures to visually inspect AMI meters?

Commented [JW36R35]: PGE Meter Services & Field Operations (MSFO) maintains standard policies and procedures, which include requirement of field personnel to perform visual inspection of meters and meter service equipment while on-site.

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Commented [RY37]: Please specify those applications.

Commented [JW38R37]: PGE Electric Service Requirements applies to new services, relocated services, rewired services, and temporary services.

equipment plus one year. All energy diversion investigations are recorded and records are maintained for five years.

The record of the most recent accuracy test of each instrument transformer is maintained for at least as long as the instrument transformer is in service plus three years. ~~The record of each instrument transformers includes the manufacturer's name or trademark, type, and serial number. Each instrument transformer placed in service will be marked with the same information.~~

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The record of the most recent accuracy test of each watt-hour meter is maintained for at least as long as the instrument transformer is in service plus three years. Accuracy record of each watt-hour meter includes the following:

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- A. Date of test;
- B. Reason for test;
- C. Reading and accuracy of meter as found and as left;
- D. Identification of person who performed the test; and
- E. Identification of equipment used to test meter.

The record of each watt-hour meter includes the following:

- F. Manufacturer and date of purchase, along with any testing data provided by the manufacturer that is used by the entity for acceptance testing of the meter;
- G. Manufacturer or Company's identification number;
- H. Date and place of present or most recent installation
- I. Date and type of last major repair, or of final disposition;
- J. Nameplate data, which includes:
 - i. Form designation or circuit description;
 - ii. "Watt-hour meter" or other description;
 - iii. Manufacturer's name or trademark;
 - iv. Manufacturer's type;
 - v. Electrical current class;
 - vi. Rated voltage;
 - vii. Number of wires;
 - viii. Frequency;
 - ix. Test amperes;
 - x. Watt-hour meter constant; and
 - xi. Watt-hour meter test constant (if applicable).

14. Meter Tests Requested by Customers

If a customer requested that a meter that serves their account be tested for accuracy, the Company shall test the customer's meter, ~~in accordance with OAR 860-021-0130.~~

Deleted: at no cost to the customer, within 30 days after receiving the request, unless the customer gives consent that the meter be tested in a later date. The Company shall perform the test at the meter installation location and in the customer's presence, unless the customer gives consent for the meter to be removed and/or tested outside the customer's presence. The Company shall provide the customer with a written report on the meter test result within 7 days after the test. If the meter is found to over-register by more than 0.3%, the Company shall make any necessary metering data correction.¶

¶ The Company may elect to charge the customer \$100 if the customer requested a second test for the same meter within 12 months after the first test. If upon the second test the meter is found to over-register by more than 0.3%, the Company shall reimburse the customer the \$100 paid for the second test. The Company shall make any necessary metering data correction.

15. Treatment of Inaccurate Metering Data

Upon discovery that a meter serving a customer is outside acceptable OPUC limits as defined in OAR 860-021-0130, the Company shall correct the metering error. The Company shall direct its billing department to adjust customer bills according to the corrected metering data and reimburse customer for all overcharges as defined in OAR 860-021-0135.

Deleted: over-registers by more than 0.3%

Deleted: . Metering data correction should be based on the actual percentage of error, and should cover the previous 24 months, unless the Company proves that the error existed for a period that is less than 24 months.

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Deleted: Upon discovery that a meter serving a customer under-registers by more than 0.3%, the Company shall correct the metering error. Metering data correction should be based on the actual percentage of error, and should cover the previous 12 months. The Company may direct its billing department to adjust customer's bills according to the corrected metering data, and work with the customer for payment of the under-billed usage. However, the Company is not allowed to charge the customer for the under-billed usage if testing and accuracy requirements of this policy have not been met.

16. Annual Metering Management Review

PGE will annually evaluate the currency of its metering policies, practices and procedures with updated national and state regulations, standards and guidelines. PGE will maintain a documented management review program to ensure compliance with OPUC regulations and established company policies and directives.

17. Annual Report and Certification to OPUC

Meter Services will submit an annual certification report to the Commission as set out in Section S of the OPUC's Electric utility Metering Policy. Included in the report are:

- A. Company's analysis of newly purchased watt-hour meter accuracy tests provided by the manufacturers
- B. Meter group descriptions
- C. Number of meters in the group
- D. Number of meters tested per group
- E. Mean of the as-found Average Accuracy for each group
- F. Standard deviation of the as-found Average Accuracy for each group
- G. High/low range of the as-found Average Accuracy for each group
- H. Percentage above/below 100 + 2 % Average Accuracy for each group
- I. Number of meters uniquely defective per HMG group listed by cause and analysis of defects
- J. Company's analysis of in-service periodic meter testing
- K. Proposed action for future testing and maintenance based on test results
- L. Meter Audit failures listed by cause and analysis of defects for PMG's
- M. Nonconformance Revenue Implications
- N. The number of qualified personnel employed by PGE
- O. Executive Summary of Annual Metering Management Review

Commented [RY39]: Is PGE willing to share the annual evaluation with Commission Staff, or include it in the Annual Certification Report?