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COMPANY NAME: PORTLAND GENERAL ELECTRIC COMPANY

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Report is required by: OAR 860-023-0015

Statute

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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.

Summary

The proposed revisions are made to Portland General Electric (PGE) meter test and inspection policy to align with industry practices and standards. A summary of proposed changes within each section of the policy is provided below.

Section 1 - Scope

Updated language for clarity.

Section 2 – General

Updated language to reflect solid-state meter components.

Section 3 – References

Industry standards updated with latest applicable revision dates.

Section 4 – Definitions

List of definitions arranged alphabetically.

Section 5 – Watt-hour Standards and Standardizing Equipment

Removed verbiage detailing example of field notification for watt-hour standard calibration. Language updated throughout.

Section 6 – Meter Quality Assurance

Removed requirement for 100% testing performed by PGE for meters removed from service. All meters removed from service are required to be tested prior to re-installation. Manufacturer is required to test all meters before shipment and test records are received and validated prior to acceptance testing of new meters, in accordance with ANSI C12.1-2014.

Removed non-industry standard acceptance testing verbiage. PGE adheres to acceptance testing of new meter shipments per ANSI Z1.4-2003 (R2013).

Removed calibration language. Solid-state meters are not capable of calibration.

Section 7 – In-Service Random Sample Meter Testing

Updated description of meters to reflect solid-state meter technology.

Removed non-industry standard testing and redundant verbiage. PGE adheres to in-service random sample meter testing of installed meter population per ANSI Z1.9-2003 (R2013).

Section 8 – In-Service Periodic Meter Testing

Updated description of meters to reflect solid-state meter technology.

Clarified description of periodic meter testing for services with an average load 1MW and greater.

Corrected verbiage for testing of commercial/industrial customers with average load 1MW and greater from bi-annual (twice every year) to biennial (every two years).

Updated definition of acceptable accuracy tolerance limits from 100 ± 2 percent registration to 100 ± 0.3 percent registration. Meters outside of ± 0.3 percent error will be removed from service. Meters outside of ± 2 percent error are subject to billing adjustments outlined in OAR 860-21-0135. PGE utilizes meters that meet specifications in ANSI C12.20-2015 for Electricity Meters 0.1, 0.2 and 0.5 Accuracy Classes and test plans reflect higher accuracy tolerances.

Section 9 – Instrument Transformers

Removed requirement for 100% testing performed by PGE. Manufacturer test records are received and validated prior to acceptance testing of new instrument transformers and pre-installation tests are performed in accordance with ANSI C12.1-2014.

Language updated throughout.

Section 10 – Testing and Verification Methods

Removed department specific language for meter tests.

Updated definition of acceptable accuracy tolerance limits from 100 ± 2 percent registration to 100 ± 0.3 percent registration. PGE utilizes meters that meet specifications in ANSI C12.20-2015 for Electricity Meters 0.1, 0.2 and 0.5 Accuracy Classes and test plans reflect higher accuracy tolerances.

Removed calibration language. Solid-state meters are not capable of calibration.

Section 11 – Security and Revenue Protection

Updated formatting.

Section 12 – Electric Service Requirements

Removed unnecessary language.

Section 13 – Record Keeping

Updated language for clarity.

Section 14 – Annual Metering Management Review

Updated formatting.

Section 15 – Annual Report and Certification to OPUC

Updated formatting.



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

November 27, 2019

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.

PGE stated, in the 2018 Annual Meter Test and Certification Report filed on April 26, 2019 in Section 14, that the Company would submit, for approval in 2019, an update to PGE's Meter Test and Inspection Policy, previously updated February 5, 2014. The proposed revisions to PGE's Meter Test and Inspection Policy align with industry practices and standards and most are housekeeping in nature. A summary of the proposed changes within each section of the policy is provided in Attachment A.

For added convenience, a redline version of PGE's Meter Test and Inspection Policy is included showing all revisions to the Policy. PGE requests that this Policy be approved at the January 14, 2020 public meeting and effective January 15, 2020.

Should you have any questions or comments regarding this report, please contact 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

PORTLAND GENERAL ELECTRIC METER TEST AND INSPECTION POLICY

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

Previous Revision – February 5, 2014

Revision – January 15, 2020

1. Scope

This document outlines the procedural requirements of Portland General Electric's (PGE / Company) scheduled electric metering test and verification programs. This policy is submitted to satisfy the Electric Utility Metering Policy issued on July 20, 2000 by the Oregon Public Utility Commission (OPUC).

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.

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 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 circuit.

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 has an unacceptable level of performance.
- (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, conversion, totalizing, registering and communication devices as well as enclosures, 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 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.
- (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. The reference watt-hour standard is used to certify portable watt-hour standards on an annual basis. The reference watt-hour standard is stored and used in a temperature and humidity-controlled environment.

Portable secondary watt-hour standards are certified at six-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 is maintained in a database system. A calibrated certification tag is affixed to each watt-hour standard. Each certification tag contains the calibration date, 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.

(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 and company accuracy tolerance specifications. 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 electronic meters. Any sample test lot found to be outside acceptable accuracy limits would be held from service until repaired or replaced.

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) 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).

(c) **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) **METHOD:**

Large Commercial/Industrial customers served by substation metering will receive annual 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 $\pm 0.3\%$ 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.

(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

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:

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 insure 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.

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.

14. 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.

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

PORTLAND GENERAL ELECTRIC ~~ELECTRIC METERING~~ TEST AND INSPECTION POLICY

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

~~Last Revision — November 19, 2012~~
~~Previous Updated Revision – February 5, 2014~~
~~Revision – September January 15, 27, 2014~~

1. Scope

This document outlines the procedural requirements of Portland General Electric's (PGE / Company) scheduled electric metering test and verification programs. This policy is submitted to satisfy the Electric Utility Metering Policy issued on July 20, 2000 by the Oregon Public Utility Commission (OPUC).

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.

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 register constant or~~ watt-hour constant, that is mechanically or electrically defective, incorrectly connected, installed, or applied, or that is outside acceptable ~~performance accuracy tolerances~~ levels. 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 circuit.

PGE's 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.

~~The company~~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 ~~company~~PGE employees and ~~company~~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 ~~documents~~industry and PGE standards:

- ~~PGE The Company's METER SERVICES PRACTICES~~Meter Services shall be used to 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-~~2008~~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&)~~2008 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's Oregon~~ Electric Service Requirements ~~booklet will be is~~ used at the minimumas 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) ~~(a)~~Company – Portland General Electric

(c) Defective Meter Group – An identified homogeneous group of meters, or distinct subdivision thereof, that has an unacceptable level of performance.

~~(a) Defective Meter Group – An identified homogeneous group of meters, or distinct subdivision thereof that has an unacceptable level of performance.~~

- ~~(b)(d)~~ ~~(b)~~ 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)~~ ~~(e)~~ Metering System – The entire metering circuit and installation including all sensing, measuring, conversion, totalizing, registering and communication devices as well as enclosures, wiring and communication links.
- ~~(d)~~ ~~(f)~~ NIST – National Institute of Standards and Technology, under US Dept. of Commerce.
- ~~(e)~~ ~~(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.
- ~~(f)~~ ~~(j)~~ Uniquely Defective Meter – A meter selected for random sampling with 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.
- ~~(g)~~ ~~(a)~~ ~~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.~~
- ~~(h)~~ ~~(a)~~ ~~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)~~ ~~(a)~~ ~~Company~~ ~~Portland General Electric.~~
- ~~(j)~~ ~~(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.~~

5. Watt-hour Standards and Standardizing Equipment

- (a) PURPOSE:
To ensure ~~that~~ watt-hour measurement equipment, used to test ~~the~~ accuracy of billing meters, is ~~correctly~~ calibrated and traceable to ~~the~~ National Institute of Standards Technology (NIST).
- (b) RESPONSIBILITY:
~~Portland General Electric~~ The company maintains a Standards Laboratory that is responsible for ~~the~~ certification of all portable watt-hour standards used within PGE.

(c) SUMMARY OF METHOD:

~~PGE-The company~~ uses a ~~Preferenceprimary traceable W~~watt-hour standard to ~~which compare~~ all other ~~W~~watt-hour standards ~~are compared~~ to ensure revenue meter accuracy. The calibration accuracy of the ~~Preferenceprimary~~ standard is verified at ~~6-monthsix-month~~ intervals to Standard Instruments ~~that and~~ are traceable to NIST. ~~The Preferenceprimary W~~watt-hour standard is used to certify ~~on an annual basis Sportablesecondary or Working W~~watt-hour ~~S~~standards ~~on an annual basis~~. ~~The Preferenceprimary W~~watt-hour standard is stored and used in a temperature and humidity-~~controlled~~ environment.

Portable ~~S~~secondary ~~W~~watt-hour ~~S~~standards are certified at six-month intervals by PGE's Instrument Laboratory. ~~The e~~Certification is accomplished using a comparison method with a ~~S~~secondary ~~W~~watt-hour ~~S~~standard. ~~'Calibration Due'~~ notification is sent to personnel assigned to portable field Watt-hour standards or to the Meter shop Watt-hour standards prior to the Watt-hour standard calibration due date. Field personnel will then exchange their portable standard for a newly calibrated standard of the same type. Meter shop Watt-hour standards are certified in place, at six-month intervals by Instrument Laboratory technicians using the Secondary Standards.

Documentation for all calibrations and for calibration procedures is maintained in a database system. ~~Calibration data for portable field Watt-hour standards and for meter shop Watt-hour standards are maintained in spreadsheet files.~~ A calibrated certification tag is affixed to each ~~W~~watt-hour standard ~~in a visible location~~. Each certification tag contains the calibration date, calibration due date, and the calibrating technician initials. ~~Calibrations are performed following the guidance of ANSI C12.1a-200414,~~ ANSI code for Electric Metering.

6. Meter Quality Assurance

(a) PURPOSE:-

To assure meters meet ~~PGE-Company~~ accuracy requirements before acceptance or installation in accordance to ANSI C12.1-~~2014—2008~~.

(b) RESPONSIBILITY:

~~Meter Services is responsible for testing all meters and meter equipment, with the exception of substation metering. The company requires 100% testing of all new meters or meters that were removed from service and returned to stock.~~ The meter manufacturer shall test all new single-phase and three-phase meters before being shipped to ~~the PGEcompany~~. ~~The manufacturer shall also provide certified test data for all new meters received toby the PGEcompany. PGEThe company will-is responsible for analysis of ze the-meter manufacturers test data to ensure that accuracy specifications are met.~~

(c) SAMPLING METHOD:

Sample testing of new ~~single-phase, self-contained, non-demand~~ 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. randomly selecting 2 pallets from each shipment of 20 pallets received. In the case of shipments of fewer than 20 pallets, 10% of the shipment is randomly selected for test. Accuracy~~ ~~Testing is then done performed in accordance with the based on American National Standard Code for Electricity Metering (ANSI) C12.201-2015-2008, Section 5 and PGE company accuracy -tolerance specifications. -If number of failed accuracy tests is less than limit defined in ANSI/ASQ Z1.4-2003 (R2013), shipment is accepted. See Appendices ~~XX~~ for detailed acceptance testing policy. If none of the sample tests are outside the PGE specifications on either heavy load or light load tests, the shipment will be accepted without further testing.~~

~~In the case of small shipments or when the meters represent new technology or special-use devices, PGE may elect to test more than 10% of the shipment.~~

The ~~PGE company requires~~ accuracy ~~requirement~~ for new meters at light and full loads ~~is as follows to be within~~ $\pm 0.3\%$ for electronic meters. Any sample test lot found to be outside acceptable accuracy limits would be held from service until repaired ~~or replaced or recalibrated.~~

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 ~~will~~ include ~~s~~ watt-hour meters of the following types:

- ~~Self-contained~~
- ~~Self-Contained Single-phase non-demand~~ single phase and three phase revenue meters.
- ~~Network non-demand~~
- ~~Polyphase non-demand~~
- ~~Watt-hour and demand meters and i~~ Instrument transformer rated revenue meters, equipped with demand registers, including multi-function demand with an average load less than 1Mw.

(b) METHOD:

Random sample of meters ~~will be drawn~~ are selected annually from each applicable Homogeneous Meter Group (HMG) using ~~PGE's the company m~~ Meter A asset D database, for and placed into the sample lots ~~that are scheduled for testing~~. Sample lots ~~will be are~~ created and tested in the following manner:

~~As a general rule, M meters will be are grouped by PGE equipment type, manufacturer, and model having the same design and relationship of parts. Exception to the rule will be For large HMG's over 150,000 meters, Large HMG's will be divided into sub-groups no larger than 100,000 meters are created, by serial number range. All meters meeting the defined criteria will represent a lot and will be given a lot name and lot year. From this lot a random sample and alternates will be drawn. All meters in the lot will have the same chance of being selected as a sample item.~~

~~Each gGroup's sample sizes will are be based on a table derived from ANSI/ASQ Z1.9-2003 (R2013) with a General Inspection Level II, Acceptance Quality Limit (AQL) of 2.5, and Double Specification Limit. ANSI/ASQC Z1.9-2008 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming. The statistical sampling method shall be based upon ANSI/ASQC Z1.9, Section B, Part II Double Specification Limit. An Acceptable Quality Level (AQL) is a nominal value expressed in terms of the percent of meters tested outside the specification limits. An acceptable AQL used for analysis will be 2.5 %. The Maximum Allowable Percent Defective (M) for each meter sample lot will is be determined from ANSI/ASQC Z1.9, Table B-3, "Normal Inspection". Sub lots for a single lot will not be created unless a lot fails. In the instance of a failed lot, the lot will be divided not to exceed 5% into sub-lots by chronological age or geographic area. This will be done to determine and localize the failing serial number range. This sub-lot method will continue for all subsequent years until all sub-lots pass the analysis and/or the failed sub-lot(s) are removed from service.~~

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

(c) ~~(e)~~ TEST RESULTS ANALYSIS:

Sample plan test results will be are analyzed ~~by a mathematical method~~ based on ANSI/ASQC Z1.9-20083 (R2013). ~~If the analysis of the sample indicates the Estimated Lot Percent Defective exceeds the Maximum Allowable Percent Defective (M) for two consecutive years, the unacceptable lot is considered to be a "failed" lot may be further subdivided by age, geographic location, or other factors that might affect accuracy. Additional samples will be drawn on any sub-lot that is unacceptable. The other sub-lots will require no further testing.~~

~~Those sub-lots where the Estimated Lot Percent Defective exceeds the Maximum Allowable Percent Defective (M) on the second sample test will Meters within a failed lot require re-calibration or will be retirement retired within four years, unless the lot fails due to meters running fast. Fast running meter lots will be removed from service at a more accelerated rate.~~

The company shall evaluate ~~annually the~~ uniquely defective meters ~~found identified within for~~ each HMG ~~during the previous year sample testing program.~~ ~~The evaluation will recognize meters with design or manufacturing deficiencies that demonstrate an excessive number of premature failures or are developing a history of poor performance.~~ 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 ~~watt hour and demand~~ Revenue meters that are ~~for services self-contained, except those meters~~ with an average load ~~less than 1MW and greater. to be tested and inspected as described in Section 7 of this Policy, and instrument transformer rated meters equipped with demand registers, including multi-function demand.~~

(b) METHOD:

~~Meters and metering systems covered under this test program will be tested and inspected at minimum of 12-year intervals in accordance with ANSI C12.1-2008.~~ Large Commercial/Industrial customers served by substation metering will receive annual meter testing and inspection. Commercial/Industrial customers that have an average load greater than 1Mw W will receive bi-~~annual~~ ennial meter testing and inspection. ~~Meters~~ lots will be divided into groups based on ~~PGE company~~ equipment type and manufacturer.

~~An acceptable meter shall be is~~ defined as ~~acceptable one that yields an if~~ as-found average accuracy ~~of is within~~ 100 ± 0.32 percent registration. Weighted percent registration is defined by ANSI C12.1-201408, Method 1, ~~will be the basis of calculations for weighted percent registration.~~

All meters with an error greater than ± 50.3 % in as-found testing ~~will be are declared uniquely defective and~~ 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 these uniquely defective meters will be are~~ excluded from ~~the~~ statistical analysis only if the cause of ~~the~~ error ~~can be is~~ attributed to external causes or outside forces (~~i.e.e.g.~~, vandalism, tampering, lightning, corrosive environment, etc.).

9. Metering Instrument Transformers

(a) PURPOSE:

To ensure that metering transformers are accurate in accordance to ANSI C12.1-2008~~14~~ and ANSI-IEEE C57.13.

(b) RESPONSIBILITY:

Meter ServicesThe company is responsible ~~for testing for ensuring~~ Ccurrent and Vvoltage transformers ~~that are~~ used for revenue metering are accurate and within acceptable accuracy tolerance limits. ~~Only personnel who have thorough practical and theoretical knowledge and adequate training in the use of metering transformers~~ The company shall is responsible to validate manufacturer test results. and perform field testing/verificationconduct the tests. ~~Transformer test equipment accuracy will be traceable to National Institute of Standards Technology (NIST).~~

(c) SUMMARY OF METHOD:

The company requires ~~100% testing of all~~ metering current and voltage transformers be tested by the manufacturer, new or returned from service. ~~New transformers will have~~The manufacturer will provide PGEthe company with certified test results ~~from the manufacturer 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 the installation. and will be sample tested for quality assurance. The sample will be 10% for all secondary transformers with no less than 4 transformers of any lot to be tested. New primary metering transformers will be 100% tested when received.~~

(d) TESTING:

Pre-installation tests will be performed by the manufacturer in accordance with ANSI C12.1-2014 section 5.2.1. Shop Tests will comply with ANSI C12.1-2008, SECTIONS: 5.3.2.1 and 5.3.2.2. ~~Metering current and voltage T~~transformers will be rated at 0.3 % accuracy or better. ~~Transformers that fail ANSI tests will be retired or returned to the manufacturer.~~

- ~~ANSI C12.1-2008: 5.3.2.1~~ Pre-installation Test
- ~~ANSI C12.1-2008: 5.3.2.2~~ Transformers Removed from Service

Field Testing/Verification will complies y with ANSI C12.1-2008~~2014~~, SECTION: section 5.3.2.3.2 and section 5.2.4. , 5.3.3.3, and 5.3.3.4. ~~All instrument transformers, both new and returned from service, will have a field test/verification performed within 90 days of installation. The following se tests/verifications will be~~ performed after ~~after the entire meter installation is in-service and will test/verify the following:~~ will be preformed at each meter test. If a transformer fails these tests they will be removed from service as soon as possible and tested in the shop.

- ~~ANSI C12.1-200814: 5.32.33.21~~ Burden TestIn-Service Inspection
- ~~ANSI C12.1-200814: 5.32.3.32~~ Heavy Burden TestSecondary Voltage Test

- ANSI C12.1-200814: 5.32.34.4----Inspection Secondary Voltage Test

10. Testing and Verification Methods

(a) RESPONSIBILITY:

Meter Services. The company is responsible for operating, maintaining, and revising as necessary this metering test and verification program. ~~Meter Services, or an approved contractor for PGE, will perform the t~~Tests and verifications are performed by the company or approved contractor for the company. (in field and in shop) on selected metering systems and record results.

(b) ~~(b)~~ TESTING:

~~Meters may be field tested or removed and brought back to the Meter Shop for testing. Meter covers shall not be removed prior to an as-found meter test, if possible. The meter tester shall handle meters with care during 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 C12.1-200814.

~~An acceptable meter shall be is~~ defined as one acceptable that yields an if as-found average accuracy of is within 100 ± 0.32 percent registration. Weighted percent registration is defined by ANSI C12.1-2014, Method 1. ~~ANSI C12.1-200814, Method 1, will be the basis of calculations for weighted average percent registration.~~

(c) ~~(c)~~ CALIBRATION:

~~Mechanical meters shall be adjusted if the as found average deviation of watt-hour meter test results exceed $\pm 1\%$.~~

Electronic meters will are not have their calibrated ion adjusted.

~~When adjusted, meters shall be re-calibrated to within a $\pm 0.5\%$ error tolerance at full and light load.~~

(d) ~~(d)~~ VERIFICATION:

Meter system verifications will be are preperformed on all metering installations when tested; this includes periodic and sample tests along with new, transformer service installations 690 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 ~~constant (i.e., 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](#)
- ~~J-K.~~ [Voltage measurements](#)
- ~~Voltage measurements~~
- ~~L.~~ [Current measurements](#)
- ~~K-M.~~ [Phase angle test](#)
- ~~Phase angle test~~
- ~~L-N.~~ Instantaneous power factor measurements
- ~~M-O.~~ Security of the metering system and components
- ~~N-P.~~ Accessibility of the meter and other metering devices
- ~~O-Q.~~ Safety of the metering system and site
- ~~P-R.~~ Safety and condition of the electric distribution system
- ~~Q-S.~~ Current diversion
- ~~R-T.~~ Revenue implications (i.e., customer under-billing or over-billing)

11. Security and Revenue Protection

PGE will maintain documented procedures to insure 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 PGE's the company, Oregon Electric Service Requirements, booklet.](#) ~~This publication provides an important element in ensuring proper metering installations.~~

13. Record Keeping

Records ~~will beare~~ maintained for all laboratory and field test standards by serial number. -Records for standards ~~will beare~~ maintained for the life of the equipment plus five years. -Test records ~~will beare~~ maintained for all meters and auxiliary transformers for the life of the equipment plus one year. -All energy diversion investigations ~~will beare~~ recorded and records ~~will beare~~ maintained for five years.

14. 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.

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