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COMPANY NAME: PacifiCorp d/b/a Pacific Power

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Metering Assets and Technology Annual Report

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PACIFIC POWER
A DIVISION OF PACIFICORP

825 NE Multnomah Street, Suite 2000
Portland, Oregon 97232

March 21, 2024

VIA ELECTRONIC FILING

Public Utility Commission of Oregon
Attn: Filing Center
201 High Street SE, Suite 100
Salem, OR 97301-3398

Re: RE 50—PacifiCorp's Meter Asset Management Annual Report for 2023

PacifiCorp d/b/a Pacific Power submits for filing its Meter Asset Management Annual Report for 2023 in compliance with OAR 860-023-0015.

The company respectfully requests that information requests regarding this matter be addressed to:

By email (preferred): datarequest@pacificorp.com

By regular mail: Data Request Response Center
PacifiCorp
825 NE Multnomah St., Suite 2000
Portland, OR 97232

Please direct any informal questions to Jennifer Angell, Regulatory Project Manager, at (503) 331-4414.

Sincerely,

Matthew McVee
Vice President, Regulatory Policy and Operations

Enclosure

Metering Standards Engineering

PACIFICORP 2023

METER ASSET MANAGEMENT

ANNUAL REPORT

For the period January 1 – December 31, 2023

Pacific Power and Rocky Mountain Power Divisions

Serving areas of

California, Idaho, Oregon, Utah, Washington, and Wyoming

March 2024

Submitted by:

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Benjamin Whitchurch, Senior Engineer II, Metering Standards Engineering

Prepared by:

Metering Standards Engineering

Benjamin Whitchurch, Engineer, Metering Standards Engineering

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PacifiCorp 2023

METER ASSET MANAGEMENT ANNUAL REPORT

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2023 Report on PacifiCorp Metering

Programs and Procedures to Maintain the Accuracy of Metering

1. SCOPE

1.1. This document contains information describing the programs and procedures that PacifiCorp performs to maintain the accuracy and reliability of its electrical metering system. The meter has been called the 'cash register' of the company, and for that reason, its accuracy and reliability must be ensured. The appendixes of this report contain the data that has been collected, sorted and analyzed specifically to determine the condition, accuracy and reliability of the company's billing metering population. Providing confidence in the metering system is important to the company, to the various state commissions and agencies responsible for reviewing utility operations, and to every customer of PacifiCorp.

1.2. Descriptions of the designs of the two in-service scheduled meter testing programs, sample and periodic, are contained in this report. The appendixes of this document contain the results of these two annual in-service scheduled meter-testing and inspection programs. These programs are:

- Sample testing and evaluation of randomly selected meters and associated metering installations. This program generally applies to residential and small commercial customers.
- Periodic testing, inspection and verification of customer metering installations on a set time interval. This program generally applies to larger commercial, industrial, and agricultural customers.

1.3. This report describes and relies upon nationally recognized publications for the initial valid test program design. Application of the standards from these publications to the meter testing program results determines whether a meter model or group passes or fails.

1.4. This document contains descriptions of company policies and procedures that apply to meters that no longer meet accuracy and reliability standards.

1.5. This document contains the procedural requirements for the testing and maintenance of the company's hierarchy of standardizing equipment utilized to

verify the accuracy of the field test equipment that is ultimately responsible for ensuring the accuracy of the company's customer metering population.

1.6. Other company programs that relate to metering are also described. These programs may relate to energy theft programs or to new technologies designed to bring efficiency to the reading of meters. New types of test equipment and changes in testing programs are also described.

1.7. In summary, this document contains status reports regarding:

- in-service testing, inspections and verifications
- defective meter analysis
- meter retirement programs
- watt-hour standards maintenance

2. GENERAL

2.1. This document references the following company internal work practices from *Metering Operations Practices and Procedures (MOPP)* and *Metering Standards and Engineering*; see Appendix G for selections.

- *MOPP Chapter 3 – Reference Standards*
- *MOPP Chapter 3 Section 1.4 – Corporate Watt-hour Standard Procedure*
- *Metering Standards and Engineering Policy 52 – Meter Maintenance and Testing Policy*

2.2. This document references the following nationally recognized metering standards:

- Edison Electric Institute – *Handbook for Electricity Metering, 10th Edition* – a guide for terminology and for determining homogeneous meter groupings.
- ANSI C12.1 – *2022 Code for Electricity Metering* – a guide for the testing program design, average registration calculations, and for the testing of standardizing equipment.
- ANSI/ASQ Z1.9 – *2013 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming* – to determine lot sizes and acceptability criteria for the in-service meter sample-testing program.

3. DEFINITIONS

Acceptability criteria: Accuracy performance characteristics of a homogeneous

meter group population. The acceptability criteria are specified by ANSI/ASQ Z1.9*, Part II, Double Specification Limit, Paragraph B 12.1.1;* Acceptable Criterion; Table B-3 Acceptable Quality Level of 2.50%; Table A-2 Inspection Level of G II. See Appendix A – *Sample Meter Test Analysis by Variables – ANSI Z1.9,* for each selected meter group's performance.

As-found condition code (AFCC): This two-letter code describes the condition of the meter installation as initially found by the meterman. The Customer Service System has a field to enter this code for each meter tested. See Appendix D sections 1 and 2 – *Uniquely Defective/As-found Condition Codes.*

Average percentage registration: Per ANSI C12.1–2008; 5.1.5.1 Method 1; FL=full load, LL=light load; weighted percentage registration = (4FL+LL)/5.

Billing multiplier: A multiplier applied to the meter's displayed energy and demand reads. For most meters, residential and small commercial, the billing multiplier is one. Larger installations have an instrument transformer ratio boosting the multiplier, see Instrument Transformers.

Customer Service System (CSS): The company mainframe system designed to manage metering, billing and other data.

Company: PacifiCorp, which is composed of Pacific and Rocky Mountain Power divisions. Pacific Power serves within the states of California, Oregon and Washington. Rocky Mountain Power serves within the states of Utah, Idaho and Wyoming.

Energy theft: Unauthorized manipulation of a metering service designed to alter consumption data or illegal consumption of electrical energy. Tampering with meter adjustments to cause the meter to not fully register consumption or altering the meter wiring to by-pass registration of the meter are two methods of energy theft.

Failed meter group: A meter group, meter model or serial number range of a meter model that has failed the sample testing criteria for two consecutive years per *Metering Standards and Engineering Policy 52 – Meter Maintenance and Testing Policy*. Failure is defined under ANSI/ASQ Z1.9-*2013 Sampling*

Procedures and Tables for Inspection by Variables. Any failed meter groups are presented in Appendix A – *Sample Meter Test Analysis by Variables – ANSI Z1.9*. A meter group or model that passes in subsequent years will remain a failed sample.

High maintenance meter group: A meter group that is failing at an unacceptable rate or is excessively difficult to maintain, per *Metering Standards and Engineering Policy 52 – Meter Maintenance and Testing Policy*

Homogeneous meter group: A group, model or serial number range of meters produced by a manufacturer with the same model designation of the same design or with the same manufacturing process continuity.

Instrument transformer: Includes current and voltage transformers utilized to meter high currents of 200 amperes + (400 amperes+ single phase) and voltages of 600 volts +. For example, to meter a customer requiring 400 amperes at 12,000 volts requires transforming the 400 amperes to 5 and 12,000 volts to 120. An instrument-rated type meter installed in conjunction with the instrument transformers can then accurately meter the consumption. This customer would have a billing multiplier applied to his meter readings of 400/5 x 12,000/120 = 8,000.

Meterman: PacifiCorp craft designation for personnel trained to inspect, wire and test meters and associated metering equipment.

Obsolete meter group: Meter group found to be defective mechanically or electrically and failing at a determined higher than normal rate. Age (wear) or outdated design and materials may cause failure rate.

Periodic Test Program: Meters selected for testing and site verification on a time interval. The time interval may be determined by load, energy consumption, billing multiplier, or some combination of these quantities.

Sample Test Program: Meter samples randomly selected for testing within each homogeneous group. Meters included in the Periodic Test Program are precluded from selection in the Sample Test Program. Test results are analyzed according to ANSI Z1.9.

Site verification: Verifying wiring, instrument transformer ratio, and taking phase angle measurements at the customer-metering site.

Special problem meter group: A group that suffers failure due to manufacturer defects per *Metering Standards and Engineering Policy 52 – Meter Maintenance and Testing Policy.*

Uniquely defective meter: A meter with unusable test results, including meters with broken covers, missing test data, test results outside of 10%, and meters that are inaccessible for testing. See definition for as-found condition code.

4. NEW METER QUALITY ASSURANCE

4.1. The company requires the meter manufacturers to provide test data for all new meters purchased, *Metering Standards and Engineering Policy 52 – Meter Maintenance and Testing Policy Section 2*. The meter manufacturers test all new meters before being shipped to the company and provide certified test data for these meters. The company analyzes the new meter certified test data to ensure that accuracy specifications are met.

4.2. For all new instrument-rated meters, the company has a QA evaluation and testing program to verify accuracy. All new meters are tested either before or within 90 days of installation.

5. IN-SERVICE METER TESTING PROGRAMS – SAMPLE and PERIODIC

5.1. SELECTION CRITERIA CHANGES

- The company continues to have two in-service meter testing programs: the Sample Meter Test Program and the Periodic Meter Test Program. The program selection is based on the billing multiplier divisions. The two meter programs with billing multiplier divisions and quantities are:

Test Program	Multiplier Division	Quantity Selected
Sample	less than or equal to 40	1075 meters
Periodic	greater than 40	2050 meters

- All meters selected for testing are posted on CSS as in the past. For better balance and planning of daily work, scheduled meter tests are distributed to the metermen via the company's Mobile Workforce Management (MWM) system. The MWM system can efficiently allocate quantities of meters on a daily basis within each meterman's designated work area.

5.2. SAMPLE METER TEST PROGRAM

- The sample testing program will continue to follow the statistical sampling and analysis techniques described in the American National Standard, ANSI/ASQ Z1.9, which selects the number of meters to be tested in homogeneous groups and describes the steps for analysis.

- Random samples of in-service electric meters with billing multipliers less than or equal to 40 are selected. The meters are divided into homogeneous meter groups. Manufacturer, model, and manufacturer's serial number are utilized to group the meter populations selected for sample testing and subsequent analysis. The test results are analyzed as outlined by:
  - ANSI C12.1 – *2008 Code for Electricity Metering* which provides the requirements for the sample testing program and average percentage registration definition as described in *Method 1 – weighted-average values*.
  - ANSI/ASQ Z1.9 – *2013 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming*, which provides sampling quantities and acceptability criteria for the various meter groupings.

- As in prior years, the sample meter groups tend to be self-contained with most having billing multipliers of one and set on either residential or small commercial customers. Meters with a billing multiplier greater than 40 are included in the Periodic Meter Test Program.

- The quantities of sample meters for the total company and for each state are shown in Appendix B – *Sample Meter Populations*. The percentage of total meter populations is also provided.

- Meter accuracy evaluation results are included in Appendix A – *Sample Meter*

Test Analysis by Variables – ANSI Z1.9. A graphical representation of the results is included in Appendix C – *Sample Meter Test Histogram Graphs*.

- The number of sample meter tests scheduled and completed is shown in Appendix E – *Scheduled Meter Test Counts.*

- Examples of evaluation results for past years:
  - For more than two consecutive years GE models I-14, I-16 and I-20 did not meet ANSI Z1.9 criteria and failed the Sample Meter Test Program. All GE models I-14, I-16 and I-20 have now been removed from service.

  - For two consecutive years the Westinghouse model D5S meters did not meet ANSI Z1.9 criteria and failed the Sample Meter Test Program. This meter model is listed with instructions to "retire the meter whenever a site is visited and to retire any in stock". PacifiCorp's retirement program helps ensure removal of these meters from service on a timely basis.

  - For two consecutive years the General Electric model EV meters did not meet ANSI Z1.9 criteria and failed the Sample Meter Test Program. This meter model is listed with instructions to "retire the meter whenever a site is visited and to retire any in stock". PacifiCorp's retirement program helps ensure removal of these meters from service on a timely basis.

5.3. PERIODIC METER TEST PROGRAM

- The company's periodic testing and site verification program is generally derived from American National Standard, ANSI C12.1-2022, Appendix D, with specific company selection criteria based on meter billing multiplier.

- The periodic testing and site verification program is divided into 2-, 8- and 16-year test intervals based on billing multiplier. This program is designed to ensure proper and accurate metering equipment operation for customers with larger billing multipliers. Meters with billing multipliers less than or equal to 40 are included in the Sample Meter Test Program.

Test Interval	Multiplier Division
2-Year	greater than or equal to 600

8-Year	greater than or equal to 80 and less than 600
16-Year	greater than to 40 and less than 80

- At each meter site, the company meterman conducts an inspection, looking for any evidence of deterioration, wiring problem, tampering, theft or unsafe conditions. Site verification tests are performed to verify wiring, instrument transformer ratios and burden performance, current to voltage phase relationships or power factor, and meter accuracy. The Customer Service System (CSS) is also reviewed to verify correct tariff, metering multiplier and other information that ensures accurate billing.

- For the number of periodic meter tests scheduled and completed see Appendix E – *Scheduled Meter Test Counts*.

6. UNIQUELY DEFECTIVE METER ANALYSIS

6.1. When visiting the sample and periodic test meter sites, the meterman assigns "as-found condition codes" based on what is determined to be the initial condition of the metering installation.

6.2. These two-letter as-found condition codes are analyzed and evaluated for trends as part of a Uniquely Defective Meter Analysis Program; see Appendix D sections 1 and 2 – *Uniquely Defective/As-found Condition Codes*. The company's Metering Standards Engineering group evaluates the Uniquely Defective/As-found Condition meter lists developed from the sample and periodic testing programs.

6.3. The evaluation process is intended to identify meter groups with design or manufacturing problems as well as those developing a history of poor performance. The evaluation includes the analysis of design or manufacturing deficiencies that could eventually lead to accuracy or meter failure problems. Meter groups with problems are identified and, if appropriate, incorporated into a retirement program.

6.4. The analysis includes examination of any logical sub-groups within homogeneous groups, geographic areas, serial number ranges, meter age and consultations with the meter manufacturers.

7. METER RETIREMENT PROGRAMS

7.1. The company's Metering Standards Engineering group evaluates the Sample Test Program, Appendix A, as well as the Uniquely Defective/As-found Condition Codes for both the Sample and Periodic Test Programs, Appendix D sections 1 and 2, to determine if a retirement program should be established for any identifiable meter groups, models or subgroups.

7.2. Some meter models and groups are given a meter retirement code in which a meter, within the model or group definition, is to be removed from service whenever the meter site is visited by a journeyman meterman or single phase specialist and to retire any of these meters that remain in stock. Meters with this retirement code are show in policy 52 – Meter Maintenance and Testing Policy.

8. WATT-HOUR STANDARDS

8.1. The company's Metering Standards Engineering department maintains a certification program for watt-hour standards as specified in ANSI C12.1 – *2008 Section 3* and the PacifiCorp *MOPP Chapter 3 Section 1*.

8.2. The company maintains a basic watt-hour reference standard, the RD-22 Reference Standard, that is certified annually with an approved testing laboratory traceable to the National Institute of Standards and Technology (NIST). The RD-22 Reference Standard is kept at the Portland Meter Engineering Shop and is maintained and operated by the local meterman.

8.3. The company certifies portable reference standards to the company's transfer standard every three months, as specified in the PacifiCorp *MOPP Chapter 3 Section 1.4 - PacifiCorp Watt-hour Standard Procedure.* These portable standards have an accuracy rating of 0.025% and are carried by the Metering Standards Engineering department's metering administrators to recertify each meterman's test board standard annually to an accuracy rating of 0.05%.

9. ENERGY THEFT and REVENUE PROTECTION

9.1. The Metermen submit a report on metering problems that may have resulted in a billing error. The type of meter problem, calculated dollar losses, and the resolution on collection of the losses are documented.

10. 2023 METERING (January 1, 2023 to December 31, 2023)

10.1. Off-site Meter Reading (OMR) – The meter department continues its policy to install AMR-type meters as replacements, in new installations, and difficult-to-access locations throughout Wyoming and Washington. These meters transmit a register value which is received by the meter reader's handheld devices as the reader follows the route past these residences and businesses, no longer needing to access the backyards to deal with dogs or other safety hazards.

Rocky Mountain Power completed deployment of the advanced metering infrastructure (AMI) network in Idaho and Utah and began using AMI-type meters as replacements and on new installations. The meter department also installs AMI-type meters as replacements and in new installations in California, and Oregon.

Appendix A_1
PacifiCorp 2023
Sample Test Analysis by Variables - ANSI/IEEE Z1.9

ELSTER (ABB/Westinghouse)

Group	Note	Lot Size[2]	Sample Size[4]	Meter Tests	Tests not Cmpl[11]	Outside 10%[11]	Mean Bar X[5]	Std Dev Sigma	Q_U[6]	Q_L[6]	% P_U[7]	% P_L[7]	% P[8]	% M[9]	M-P	Pass / Fail[10]	Failed Model List[12]
AEXT		20	4	8	0	0	99.293	1.8256	1.483	0.708	0.67	26.67	27.34	10.88	-16.46	Fail	**N**
ALPHA		213	15	16	0	0	99.947	0.1048	19.594	18.587	0.00	0	0.00	6.55	6.55	Pass	
ALPHA+		151	15	15	0	0	99.925	0.0896	23.171	21.489	0.00	0	0.00	6.55	6.55	Pass	
ALPHA-1		3	3	3	0	0	100.043	0.0431	45.375	47.384	0.00	0	0.00	7.59	7.59	Pass	
D4		72	7	8	0	0	100.061	0.2064	9.394	9.988	0.00	0	0.00	8.4	8.40	Pass	
D5		165	15	16	0	0	99.881	0.3835	5.526	4.905	0.00	0	0.00	6.55	6.55	Pass	
		604	55	58	0	0											

Appendix A_1
PacifiCorp 2023
Sample Test Analysis by Variables - ANSI/IEEE Z1.9

GENERAL ELECTRIC

Group	Note	Lot Size[2]	Sample Size[4]	Meter Tests	Tests not Cmpl[11]	Outside 10%[11]	Mean Bar X[5]	Std Dev Sigma	Q_U[6]	Q_L[6]	% P_U[7]	% P_L[7]	% P[8]	% M[9]	M-P	Pass / Fail[10]	Failed Model List[12]
I-50		22	4	5	0	0	100.112	0.2476	7.625	8.530	0.00	0	0.00	10.88	10.88	Pass	
I-60		37	5	6	0	0	100.063	0.1648	11.754	12.518	0.00	0	0.00	9.8	9.80	Pass	
I-70		1949	50	53	0	0	99.670	1.2533	1.859	1.332	3.05	9.09	12.14	5.21	-6.93	Fail	**N**
I-210		166	15	16	0	0	100.016	0.1002	19.813	20.125	0.00	0	0.00	6.55	6.55	Pass	
I-210+c		626210	200	208	0	1	100.063	0.0934	20.735	22.082	0.00	0.004	0.01	4.39	4.38	Pass	
KV		224	15	16	0	0	99.923	0.2707	7.674	7.104	0.00	0	0.00	6.55	6.55	Pass	
KV2C		11631	100	105	0	1	99.944	0.1065	19.308	18.254	0.00	0.003	0.01	4.67	4.66	Pass	
KV2CP		39548	150	151	0	1	100.034	0.1234	15.936	16.484	0.00	0.003	0.01	4.42	4.41	Pass	
VM-N	*	2	2	2	0	0	99.937	0.0570	36.193	33.982						Pass	
V-N		6	3	4	0	0	100.096	0.0692	27.521	30.281	0.00	0	0.00	7.59	7.59	Pass	
		679795	544	566	0	4											

* Lot size was not large enough to perform standard statistical analysis.

Appendix A_1
PacifiCorp 2023
Sample Test Analysis by Variables - ANSI/IEEE Z1.9

LANDIS + GYR (Siemens/L&G/Duncan)

Group	Note	Lot Size[2]	Sample Size[4]	Meter Tests	Tests not Cmpl[11]	Outside 10%[11]	Mean Bar X[5]	Std Dev Sigma	Q_U[6]	Q_L[6]	% P_U[7]	% P_L[7]	% P[8]	% M[9]	M-P	Pass / Fail[10]	Failed Model List[12]
MS		723	25	27	0	0	100.076	0.1589	12.109	13.060	0.00	0	0.00	5.98	5.98	Pass	
MX		728	25	27	0	0	99.891	0.4410	4.781	4.288	0.00	0	0.00	5.98	5.98	Pass	
		1451	50	54	0	0											

Appendix A_1
PacifiCorp 2023
Sample Test Analysis by Variables - ANSI/IEEE Z1.9

ITRON (Schlumberger/Sangamo)

Group	Note	Lot Size[2]	Sample Size[4]	Meter Tests	Tests not Cmpl[11]	Outside 10%[11]	Mean Bar X[5]	Std Dev Sigma	Q_U[6]	Q_L[6]	% P_U[7]	% P_L[7]	% P[8]	% M[9]	M-P	Pass / Fail[10]	Failed Model List[12]
CENTRON		1163034	200	208	0	1	100.008	0.1411	14.117	14.229	0.00	0.004	0.01	4.39	4.38	Pass	
GEN5RIVA PP		6345	75	79	0	0	99.948	0.2986	6.873	6.523	0.00	0.002	0.00	4.83	4.83	Pass	
GEN5RIVA SP		190956	200	205	0	0	100.069	0.0549	35.150	37.659	0.00	0.004	0.01	4.39	4.38	Pass	
J3S		35	5	6	0	2	99.755	0.7627	2.944	2.300	0.00	0	0.00	9.8	9.80	Pass	
J4S		641	25	27	0	0	99.840	0.3805	5.676	4.836	0.00	0	0.00	5.98	5.98	Pass	
J5S		136	10	11	0	0	99.827	0.2650	8.199	6.894	0.00	0	0.00	7.26	7.26	Pass	
SENTINEL		125	10	11	0	0	100.043	0.0397	49.311	51.464	0.00	0	0.00	7.26	7.26	Pass	
SS	*	1	1	1	0	0	100.094	0.0000								Pass	
		1361273	526	548	0	3											

* Lot size was not large enough to perform standard statistical analysis.

Appendix A_1
PacifiCorp 2023
Sample Test Analysis by Variables - ANSI/IEEE Z1.9

Notes:

For Notes 2-10 refer to ANSI/ASQ Z1.9-2013:

2 Lot size is the number of in-service sample meters for a particular meter model or group in all PacifiCorp areas at the beginning of the last test year. If lot size is less than 100 no sample is taken. These, generally older meters with small lots, are targeted for removal.

3 Table A-2 for 'Code Letter' under 'General II' column as determined by 'Lot Size' (not displayed).

4 Table B-2 for 'Sample Size' as determined by 'Sample Size Code Letter'.
Each letter code is increased of 5% to account for incomplete tests, unable to test, and for tests outside +/-10%.

5 Mean or Bar X is calculated using the weighted average formula; % Registration = (4xFull Load + Light Load)/5.

6 Q_U and Q_L are the calculated upper and lower quality indicies; Q_u = (102% - Bar X) / Sigma; Q_L = (Bar X - 98%) / Sigma

7 Table B-5; for P_U and P_L, 'Estimate of Percent Non-Conforming'.

8 Total of the Estimate for Percent Non-Conforming; $P = P_U + P_L$.

9 Table B-3; for %M, 'Max allowable percent non-conforming' at 'Acceptable Quality Levels (normal inspections)' of '2.50'.

10 If Q_U or Q_L<0;

11 'Incomplete' and 'Outside 10%' accuracy tests are counted but not used in the analysis calculations.
'Incomplete Tests' are missing test data or have zeros entered.
'Outside 10%' tests for full or light load have test data that is less than 90% or greater than 110% registration.

12 'Failed' means that the meter model has failed the Sample Test Program for 2-consecutive years, see Appendix A_2.

***** Additional tests performed during reporting year that were not part of scheduled test program

Appendix A_1
PacifiCorp 2023
Sample Test Analysis by Variables - ANSI/IEEE Z1.9

Meter Models that Failed Sample Test Program

Manufacturer	Model	Serial # Range	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Failed Model
Elster	Alpha-1	all												yes		
Elster	AEXT	all													yes	
GE	EV	all	yes	yes					yes							yes
GE	I-50	all												yes		
GE	I-70	all													yes	
GE	KV	all			yes											
Sangamo	J3	all					yes									
Westinghouse	D4	all						yes								
Westinghouse	D5	all	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*								yes

Notes:
1. ANSI Z1.4 criteria determined failure for the years 1997 and 1998
2. ANSI/IEEE Z1.9 criteria determined failure for the years 1999 and later
3. ***'Failed Models'*** have failed the Sample Test Program, per ASQ Z1.9, for two consecutive years

Appendix B

PacifiCorp 2023

Sample Meter Populations as of December 31, 2022

TOTAL COMPANY

Manufacturer	Model	Count	% of Company Total
Aclara/General Electric	KV2C	35,128	2.5037%
	KV2C5	1,129	0.0805%
Elster/ABB/Westinghouse	AB1	55	0.0039%
	ALPHA	474	0.0338%
	ALPHA+	87	0.0062%
	ALPHA-1	72	0.0051%
	D4S	83	0.0059%
	D5S	188	0.0134%
General Electric	EV-2,3,4,5,6	24	0.0017%
	I-210	328	0.0234%
	I-50,55	30	0.0021%
	I-60	44	0.0031%
	I-70	1,984	0.1414%
	KV,KV2	279	0.0199%
	KV2C	2,881	0.2053%
	KV2C+	1,068	0.0761%
	KV2CS	2,882	0.2054%
	KVS	47	0.0033%
	V-2,3,6,9,62,63,64,65,66	29	0.0021%
	VM-62,62,64,65,66,612	4	0.0003%
Itron/Schlumberger/Sangamo	CENTRON	1,154,362	82.2769%
	GEN5RIVA	198,961	14.1809%
	J3S	39	0.0028%
	J4S	642	0.0458%
	J5S	140	0.0100%
	P30,PW	4	0.0003%
	SENTINEL	504	0.0359%
	SL2,3,4,5,6,12,S5DA	84	0.0060%
Landis & Gyr/Siemens/L&G/Duncan	MS	731	0.0521%
	MT	1	0.0001%
	MX	735	0.0524%
	2510	2	0.0001%
	Total	1,403,021	100.0000%

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Appendix B

PacifiCorp 2023

Sample Meter Populations as of December 31, 2022

CALIFORNIA

Manufacturer	Model	Count	% of State Total	% of Company Population
Aclara/General Electric	KV2C	3,148	62.2257%	8.9615%
	KV2C5	8	0.1581%	0.7086%
Elster/ABB/Westinghouse	AB1	16	0.3163%	29.0909%
	ALPHA	-	0.0000%	0.0000%
	ALPHA+	1	0.0198%	1.1494%
	ALPHA-1	-	0.0000%	0.0000%
	D4S	6	0.1186%	7.2289%
	D5S	40	0.7907%	21.2766%
General Electric	EV-2,3,4,5,6	-	0.0000%	0.0000%
	I-210	2	0.0395%	0.6098%
	I-50,55	1	0.0198%	3.3333%
	I-60	-	0.0000%	0.0000%
	I-70	428	8.4602%	21.5726%
	KV,KV2	-	0.0000%	0.0000%
	KV2C	12	0.2372%	0.4165%
	KV2C+	1	0.0198%	0.0936%
	KV2CS	28	0.5535%	0.9715%
	KVS	-	0.0000%	0.0000%
	V-2,3,6,9,62,63,64,65,66	-	0.0000%	0.0000%
	VM-62,62,64,65,66,612	-	0.0000%	0.0000%
Itron/Schlumberger/Sangamo	CENTRON	830	16.4064%	0.0719%
	GEN5RIVA	-	0.0000%	0.0000%
	J3S	-	0.0000%	0.0000%
	J4S	84	1.6604%	13.0841%
	J5S	41	0.8104%	29.2857%
	P30,PW	-	0.0000%	0.0000%
	SENTINEL	-	0.0000%	0.0000%
	SL2,3,4,5,6,12,S5DA	-	0.0000%	0.0000%
Landis & Gyr/Siemens/L&G/Duncan	MS	198	3.9138%	27.0862%
	MT	-	0.0000%	0.0000%
	MX	215	4.2499%	29.2517%
	Total	5,059	100.0000%	0.3606%

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Appendix B

PacifiCorp 2023

Sample Meter Populations as of December 31, 2022

IDAHO

Manufacturer	Model	Count	% of State Total	% of Company Population
Aclara/General Electric	KV2C	8	0.0093%	0.0228%
	KV2C5	12	0.0140%	1.0629%
Elster/ABB/Westinghouse	AB1	-	0.0000%	0.0000%
	ALPHA	132	0.1542%	27.8481%
	ALPHA+	19	0.0222%	21.8391%
	ALPHA-1	57	0.0666%	79.1667%
	D4S	9	0.0105%	10.8434%
	D5S	22	0.0257%	11.7021%
General Electric	EV-2,3,4,5,6	-	0.0000%	0.0000%
	I-210	-	0.0000%	0.0000%
	I-50,55	6	0.0070%	20.0000%
	I-60	7	0.0082%	15.9091%
	I-70	31	0.0362%	1.5625%
	KV,KV2	46	0.0537%	16.4875%
	KV2C	176	0.2056%	6.1090%
	KV2C+	137	0.1600%	12.8277%
	KV2CS	33	0.0385%	1.1450%
	KVS	19	0.0222%	40.4255%
	V-2,3,6,9,62,63,64,65,66	12	0.0140%	41.3793%
	VM-62,62,64,65,66,612	2	0.0023%	50.0000%
Itron/Schlumberger/Sangamo	CENTRON	1,065	1.2439%	0.0923%
	GEN5RIVA	83,716	97.7808%	42.0766%
	J3S	-	0.0000%	0.0000%
	J4S	4	0.0047%	0.6231%
	J5S	4	0.0047%	2.8571%
	P30,PW	-	0.0000%	0.0000%
	SENTINEL	29	0.0339%	5.7540%
	SL2,3,4,5,6,12,S5DA	51	0.0596%	60.7143%
Landis & Gyr/Siemens/L&G/Duncan	MS	10	0.0117%	1.3680%
	MT	-	0.0000%	0.0000%
	MX	7	0.0082%	0.9524%
	2510	2	0.0023%	100.0000%
	Total	85,616	100.0000%	6.1023%

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Appendix B

PacifiCorp 2023

Sample Meter Populations as of December 31, 2022

OREGON

Manufacturer	Model	Count	% of State Total	% of Company Population
Aclara/General Electric	KV2C	28,232	76.6653%	80.3689%
	KV2C5	171	0.4644%	15.1461%
Elster/ABB/Westinghouse	AB1	39	0.1059%	70.9091%
	ALPHA	56	0.1521%	11.8143%
	ALPHA+	2	0.0054%	2.2989%
	ALPHA-1	3	0.0081%	4.1667%
	D4S	66	0.1792%	79.5181%
	D5S	125	0.3394%	66.4894%
General Electric	EV-2,3,4,5,6	-	0.0000%	0.0000%
	I-210	4	0.0109%	1.2195%
	I-50,55	21	0.0570%	70.0000%
	I-60	32	0.0869%	72.7273%
	I-70	1,511	4.1032%	76.1593%
	KV,KV2	25	0.0679%	8.9606%
	KV2C	426	1.1568%	14.7865%
	KV2C+	7	0.0190%	0.6554%
	KV2CS	419	1.1378%	14.5385%
	KVS	15	0.0407%	31.9149%
	V-2,3,6,9,62,63,64,65,66	6	0.0163%	20.6897%
	VM-62,62,64,65,66,612	2	0.0054%	50.0000%
Itron/Schlumberger/Sangamo	CENTRON	3,943	10.7074%	0.3416%
	GEN5RIVA	1	0.0027%	0.0005%
	J3S	35	0.0950%	89.7436%
	J4S	554	1.5044%	86.2928%
	J5S	94	0.2553%	67.1429%
	P30,PW	-	0.0000%	0.0000%
	SENTINEL	-	0.0000%	0.0000%
	SL2,3,4,5,6,12,S5DA	1	0.0027%	1.1905%
Landis & Gyr/Siemens/L&G/Duncan	MS	521	1.4148%	71.2722%
	MT	1	0.0027%	100.0000%
	MX	513	1.3931%	69.7959%
	Total	36,825	100.0000%	2.6247%

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Appendix B

PacifiCorp 2023

Sample Meter Populations as of December 31, 2022

UTAH

Manufacturer	Model	Count	% of State Total	% of Company Population
Aclara/General Electric	KV2C	3,402	0.3413%	9.6846%
	KV2C5	842	0.0845%	74.5793%
Elster/ABB/Westinghouse	AB1	-	0.0000%	0.0000%
	ALPHA	267	0.0268%	56.3291%
	ALPHA+	23	0.0023%	26.4368%
	ALPHA-1	12	0.0012%	16.6667%
	D4S	2	0.0002%	2.4096%
	D5S	1	0.0001%	0.5319%
General Electric	EV-2,3,4,5,6	24	0.0024%	100.0000%
	I-210	162	0.0163%	49.3902%
	I-50,55	2	0.0002%	6.6667%
	I-60	-	0.0000%	0.0000%
	I-70	8	0.0008%	0.4032%
	KV,KV2	160	0.0160%	57.3477%
	KV2C	1,371	0.1375%	47.5876%
	KV2C+	349	0.0350%	32.6779%
	KV2CS	2,004	0.2010%	69.5350%
	KVS	12	0.0012%	25.5319%
	V-2,3,6,9,62,63,64,65,66	11	0.0011%	37.9310%
	VM-62,62,64,65,66,612	-	0.0000%	0.0000%
Itron/Schlumberger/Sangamo	CENTRON	872,595	87.5322%	75.5911%
	GEN5RIVA	115,244	11.5604%	57.9229%
	J3S	4	0.0004%	10.2564%
	J4S	-	0.0000%	0.0000%
	J5S	1	0.0001%	0.7143%
	P30,PW	4	0.0004%	100.0000%
	SENTINEL	353	0.0354%	70.0397%
	SL2,3,4,5,6,12,S5DA	32	0.0032%	38.0952%
Landis & Gyr/Siemens/L&G/Duncan	MS	-	0.0000%	0.0000%
	MT	-	0.0000%	0.0000%
	MX	-	0.0000%	0.0000%
	Total	996,885	100.0000%	71.0527%

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Appendix B

PacifiCorp 2023

Sample Meter Populations as of December 31, 2022

WASHINGTON

Manufacturer	Model	Count	% of State Total	% of Company Population
Aclara/General Electric	KV2C	218	0.1608%	0.6206%
	KV2C5	35	0.0258%	3.1001%
Elster/ABB/Westinghouse	AB1	-	0.0000%	0.0000%
	ALPHA	-	0.0000%	0.0000%
	ALPHA+	-	0.0000%	0.0000%
	ALPHA-1	-	0.0000%	0.0000%
	D4S	-	0.0000%	0.0000%
	D5S	-	0.0000%	0.0000%
General Electric	EV-2,3,4,5,6	-	0.0000%	0.0000%
	I-210	80	0.0590%	24.3902%
	I-50,55	-	0.0000%	0.0000%
	I-60	5	0.0037%	11.3636%
	I-70	4	0.0030%	0.2016%
	KV,KV2	6	0.0044%	2.1505%
	KV2C	443	0.3269%	15.3766%
	KV2C+	499	0.3682%	46.7228%
	KV2CS	220	0.1623%	7.6336%
	KVS	1	0.0007%	2.1277%
	V-2,3,6,9,62,63,64,65,66	-	0.0000%	0.0000%
	VM-62,62,64,65,66,612	-	0.0000%	0.0000%
Itron/Schlumberger/Sangamo	CENTRON	133,962	98.8409%	11.6049%
	GEN5RIVA	-	0.0000%	0.0000%
	J3S	-	0.0000%	0.0000%
	J4S	-	0.0000%	0.0000%
	J5S	-	0.0000%	0.0000%
	P30,PW	-	0.0000%	0.0000%
	SENTINEL	58	0.0428%	11.5079%
	SL2,3,4,5,6,12,S5DA	-	0.0000%	0.0000%
Landis & Gyr/Siemens/L&G/Duncan	MS	2	0.0015%	0.2736%
	MT	-	0.0000%	0.0000%
	MX	-	0.0000%	0.0000%
	Total	135,533	100.0000%	9.6601%

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Appendix B

PacifiCorp 2023

Sample Meter Populations as of December 31, 2022

WYOMING

Manufacturer	Model	Count	% of State Total	% of Company Population
Aclara/General Electric	KV2C	120	0.0839%	0.3416%
	KV2C5	61	0.0426%	5.4030%
Elster/ABB/Westinghouse	AB1	-	0.0000%	0.0000%
	ALPHA	19	0.0133%	4.0084%
	ALPHA+	42	0.0293%	48.2759%
	ALPHA-1	-	0.0000%	0.0000%
	D4S	-	0.0000%	0.0000%
	D5S	-	0.0000%	0.0000%
General Electric	EV-2,3,4,5,6	-	0.0000%	0.0000%
	I-210	80	0.0559%	24.3902%
	I-50,55	-	0.0000%	0.0000%
	I-60	-	0.0000%	0.0000%
	I-70	2	0.0014%	0.1008%
	KV,KV2	42	0.0293%	15.0538%
	KV2C	453	0.3166%	15.7237%
	KV2C+	75	0.0524%	7.0225%
	KV2CS	178	0.1244%	6.1763%
	KVS	-	0.0000%	0.0000%
	V-2,3,6,9,62,63,64,65,66	-	0.0000%	0.0000%
	VM-62,62,64,65,66,612	-	0.0000%	0.0000%
Itron/Schlumberger/Sangamo	CENTRON	141,967	99.2062%	12.2983%
	GEN5RIVA	-	0.0000%	0.0000%
	J3S	-	0.0000%	0.0000%
	J4S	-	0.0000%	0.0000%
	J5S	-	0.0000%	0.0000%
	P30,PW	-	0.0000%	0.0000%
	SENTINEL	64	0.0447%	12.6984%
	SL2,3,4,5,6,12,S5DA	-	0.0000%	0.0000%
Landis & Gyr/Siemens/L&G/Duncan	MS	-	0.0000%	0.0000%
	MT	-	0.0000%	0.0000%
	MX	-	0.0000%	0.0000%
	Total	143,103	100.0000%	10.1996%

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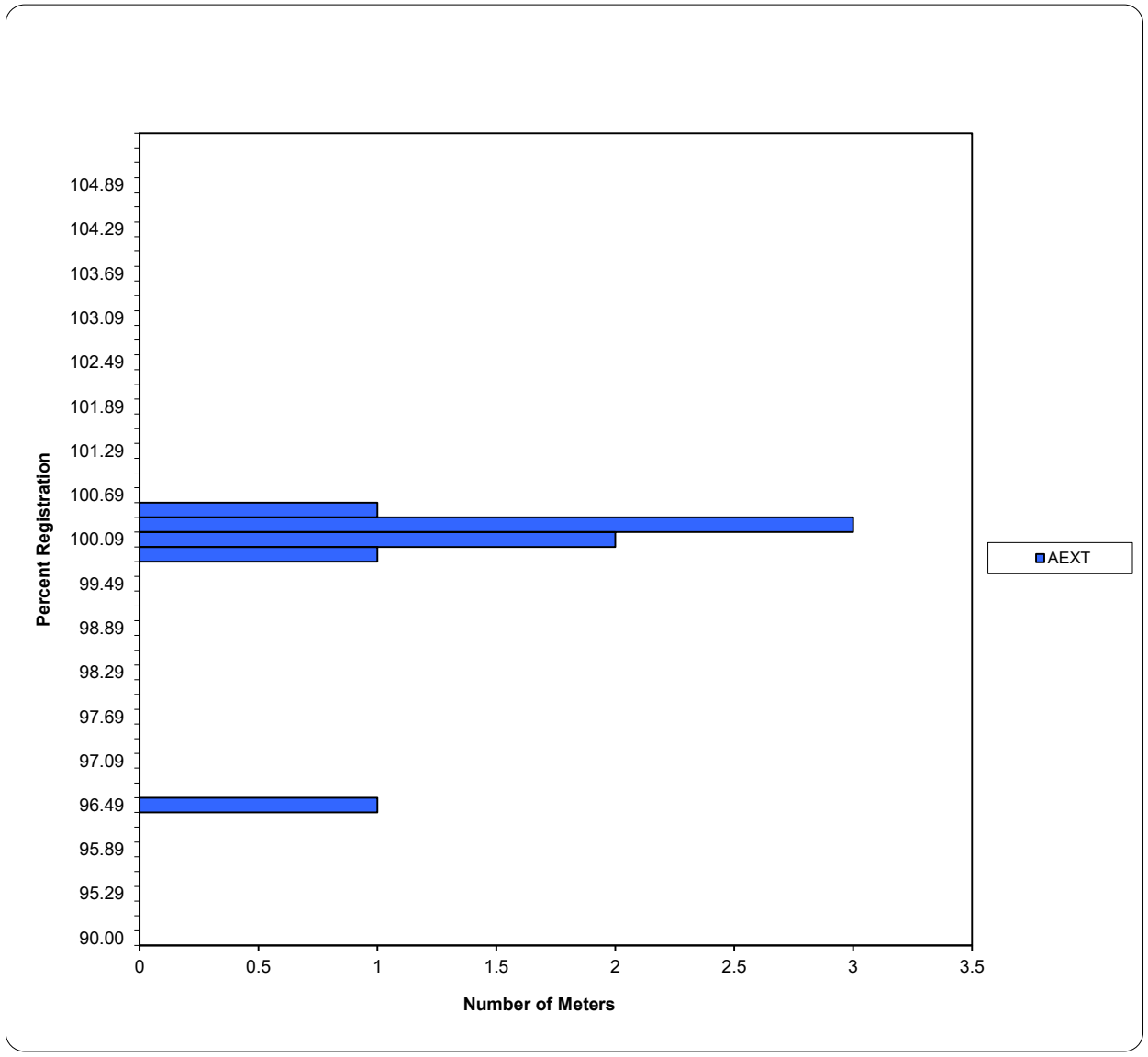
Meter Model Group: AB Weighted Avg.



Percent Registration		# of Meters
Low	High	
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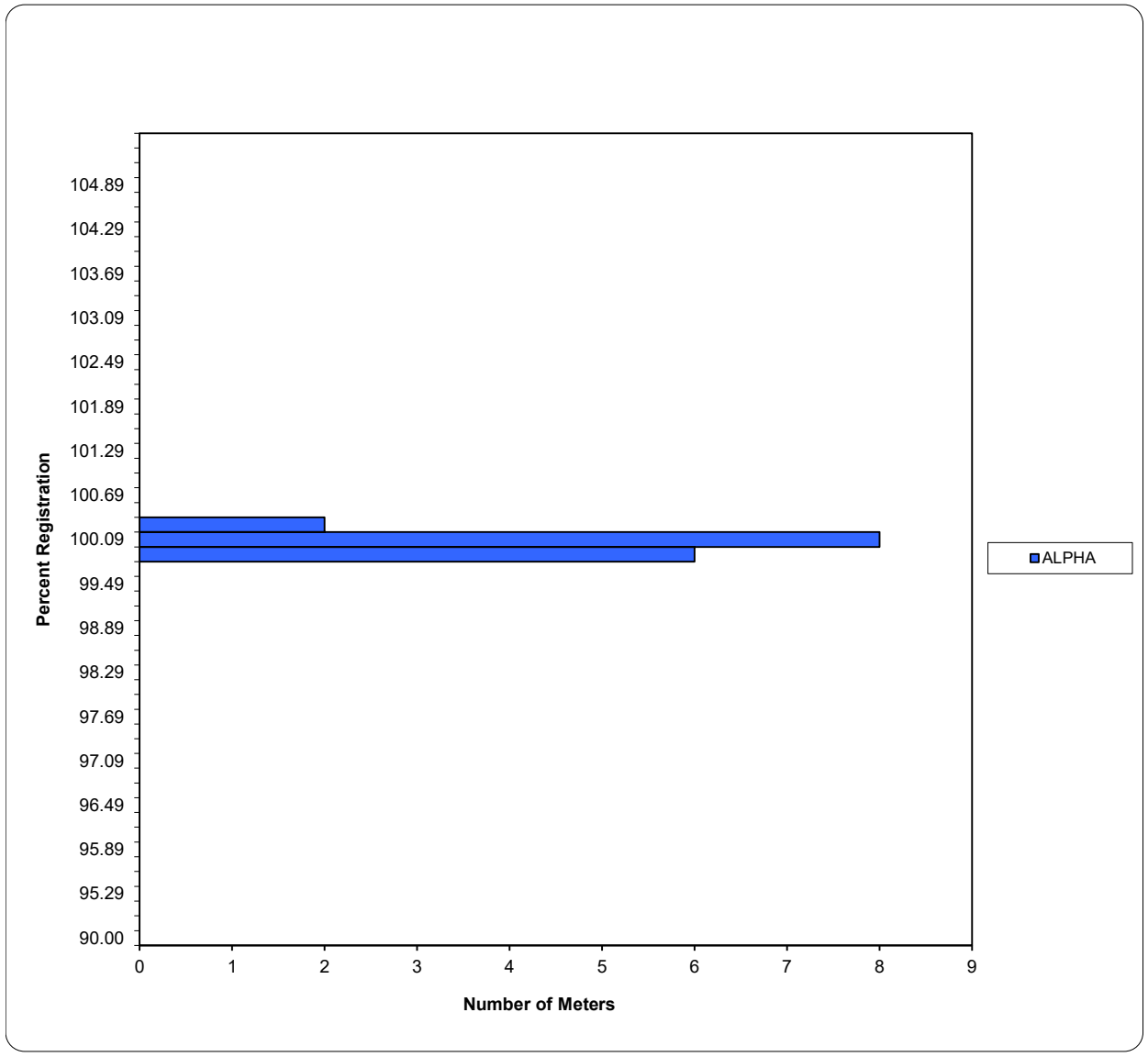
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	1
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	1
99.90	100.09	2
100.10	100.29	3
100.30	100.49	1
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Appendix C
PacifiCorp 2023

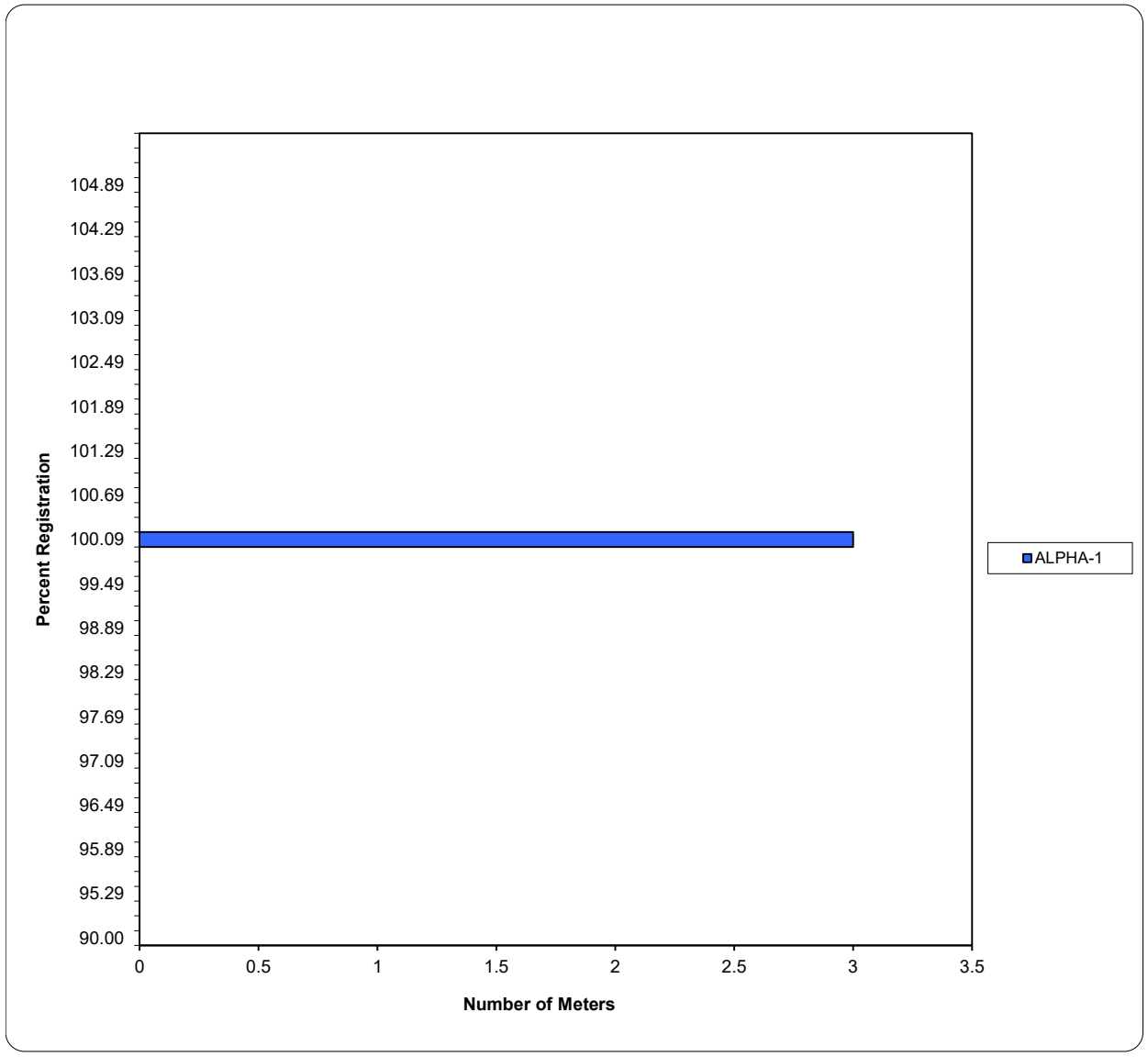
Meter Model Group: Alpha Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	6
99.90	100.09	8
100.10	100.29	2
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

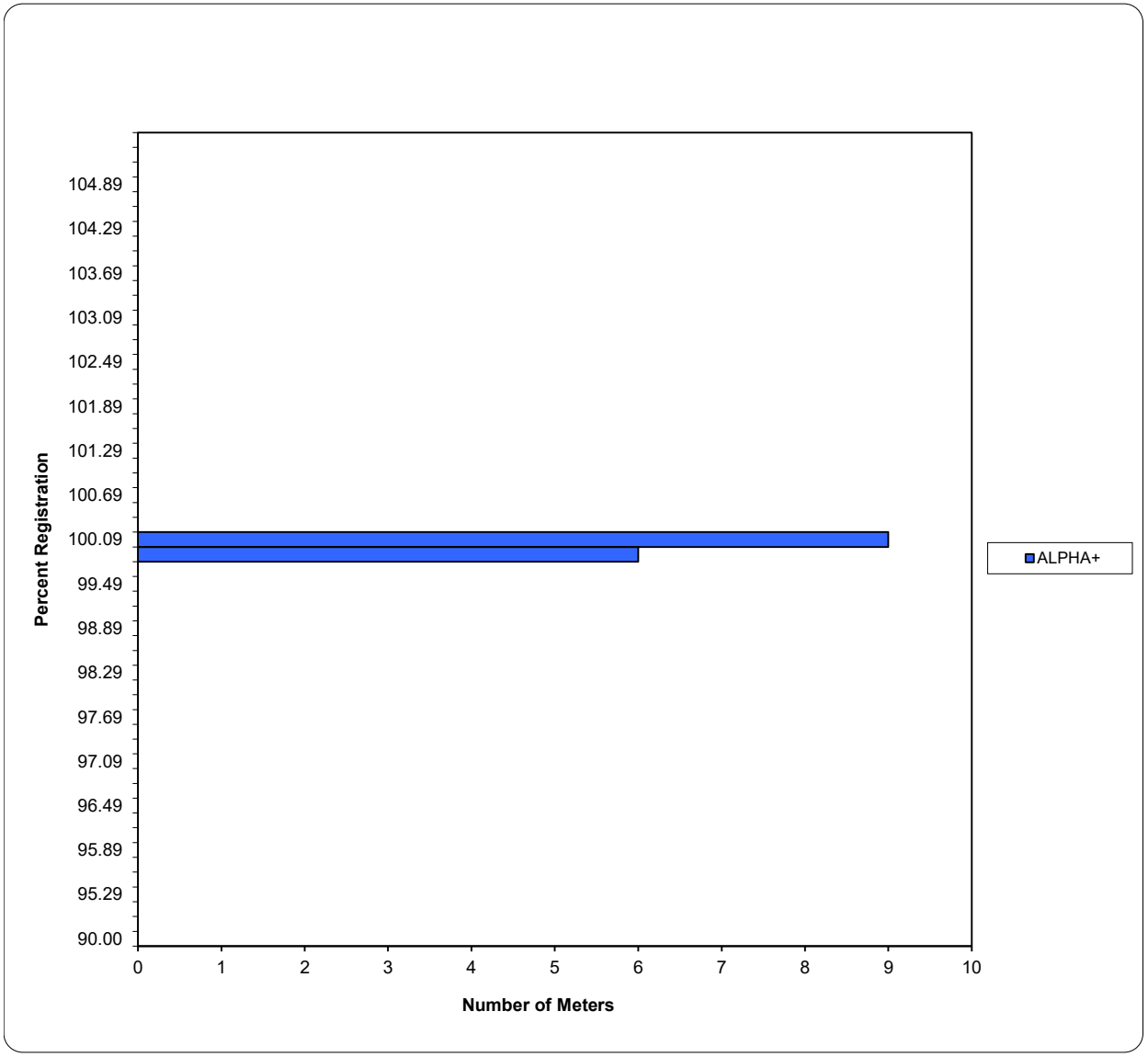
Appendix C
PacifiCorp 2023

Meter Model Group: Alpha-1 Weighted Avg.



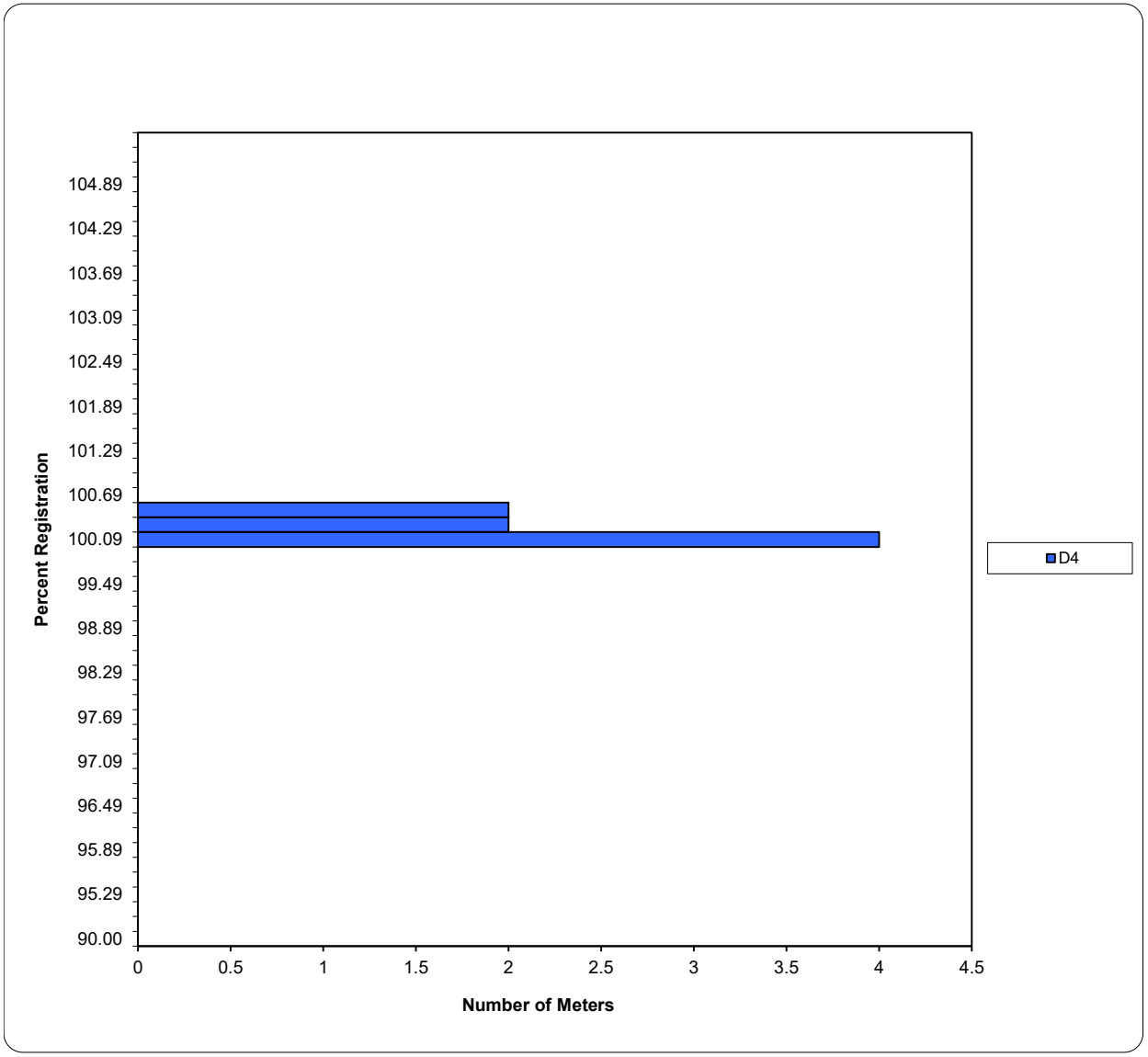
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	3
100.10	100.29	0
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: Alpha+ Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	6
99.90	100.09	9
100.10	100.29	0
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

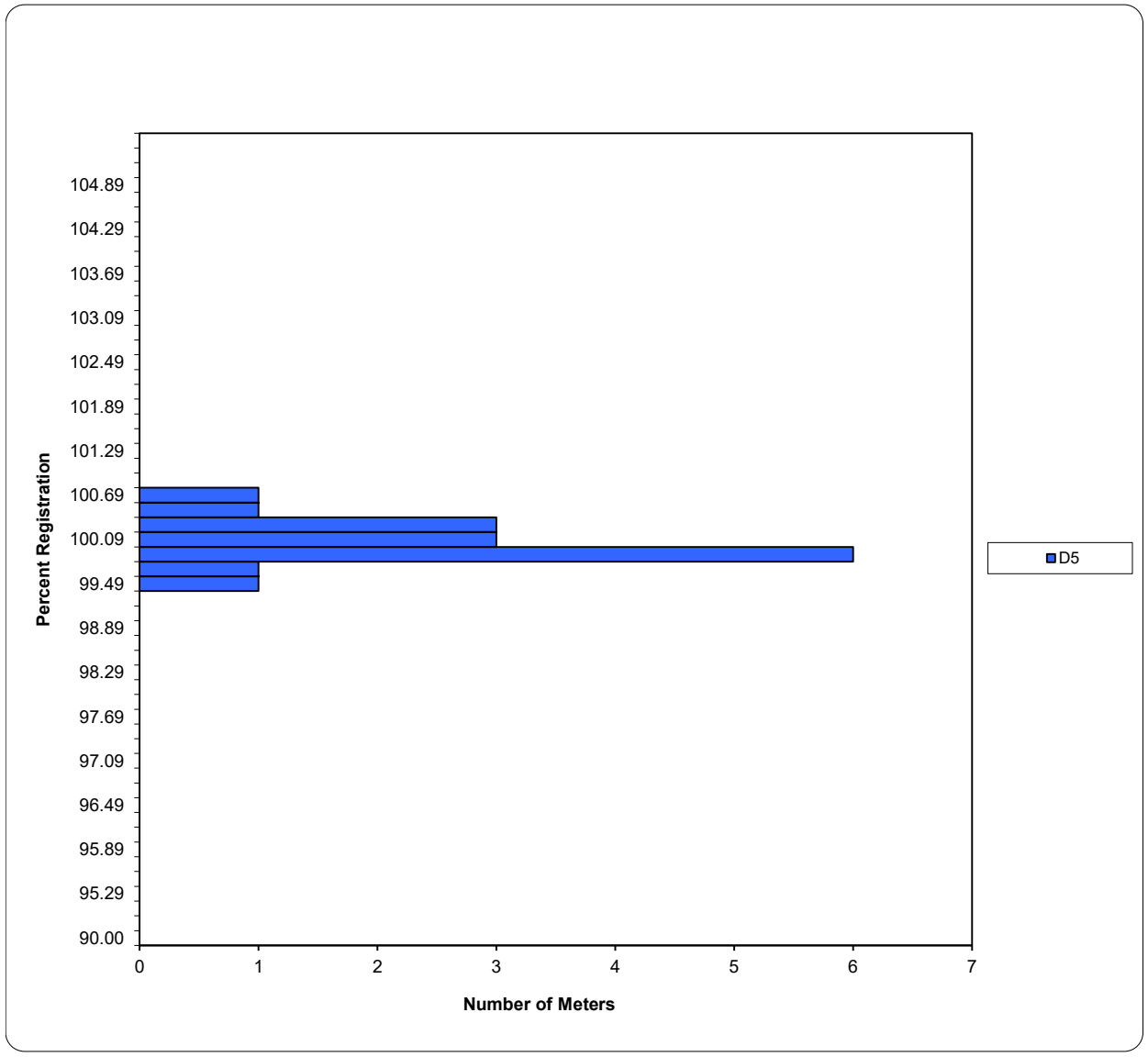
Meter Model Group: D4 Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	4
100.10	100.29	2
100.30	100.49	2
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

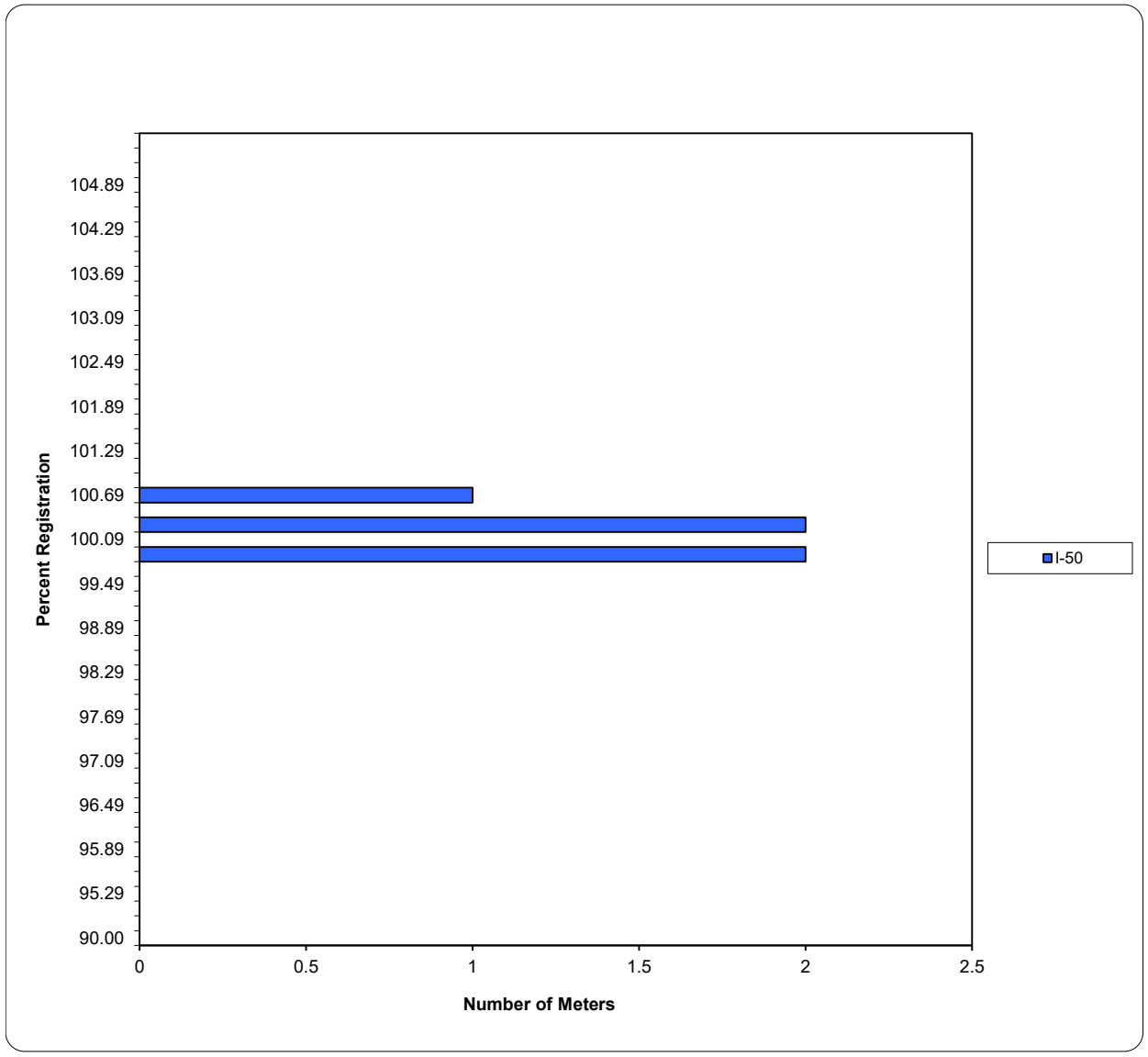
Appendix C
PacifiCorp 2023

Meter Model Group: D5 Weighted Avg.



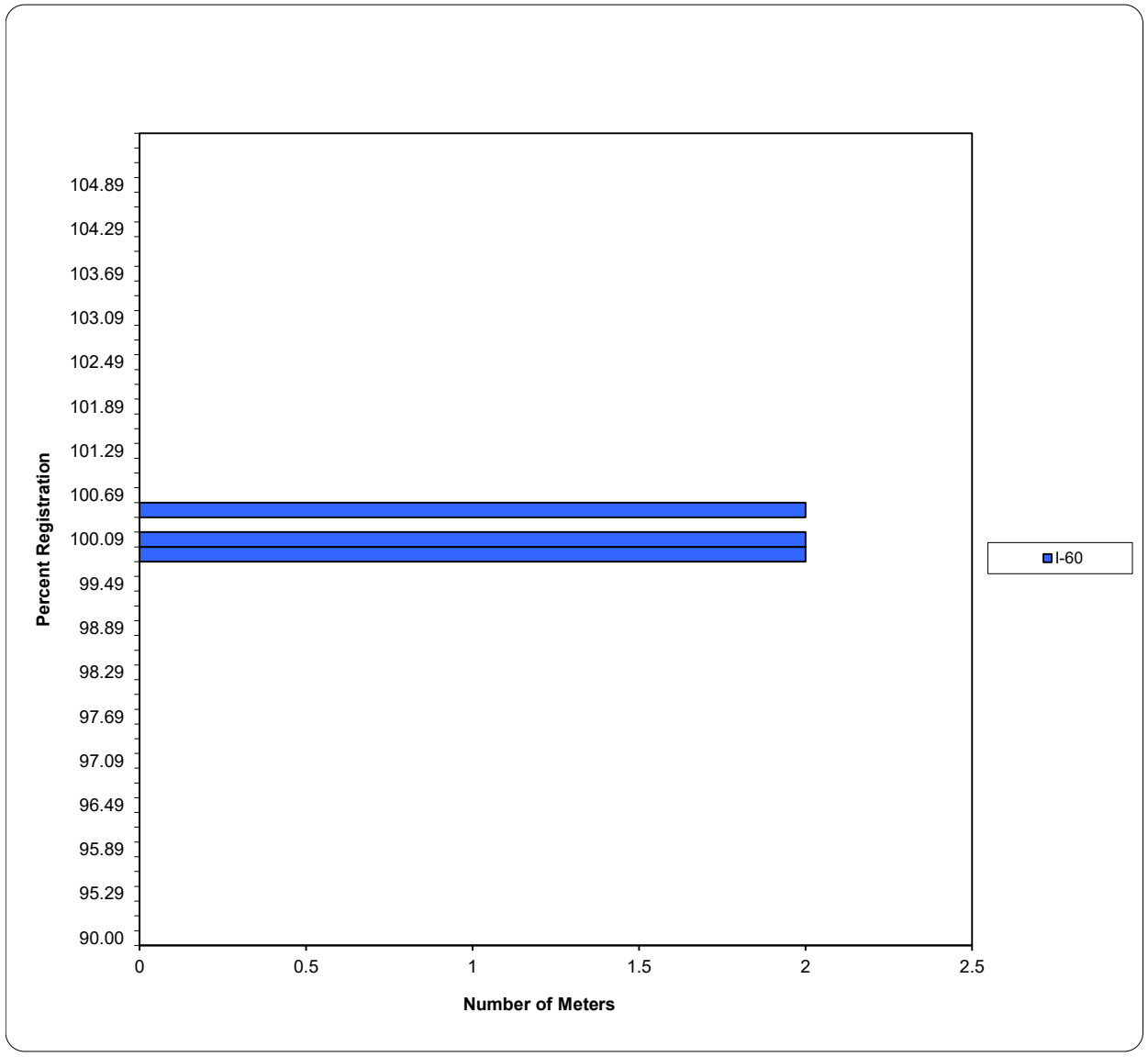
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	1
99.50	99.69	1
99.70	99.89	6
99.90	100.09	3
100.10	100.29	3
100.30	100.49	1
100.50	100.69	1
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: I-50 Weighted Avg.



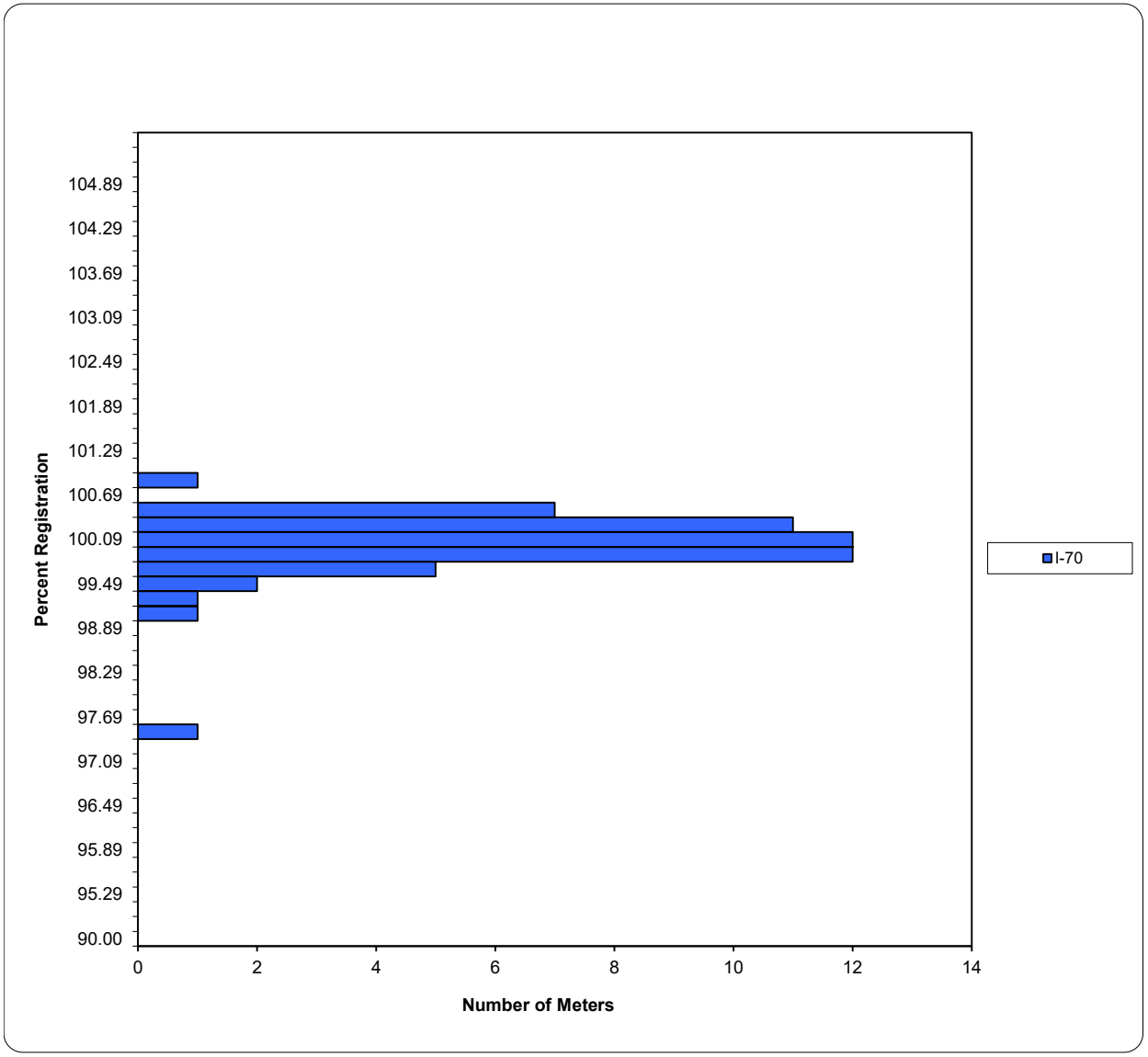
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	2
99.90	100.09	0
100.10	100.29	2
100.30	100.49	0
100.50	100.69	1
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: I-60 Weighted Avg.



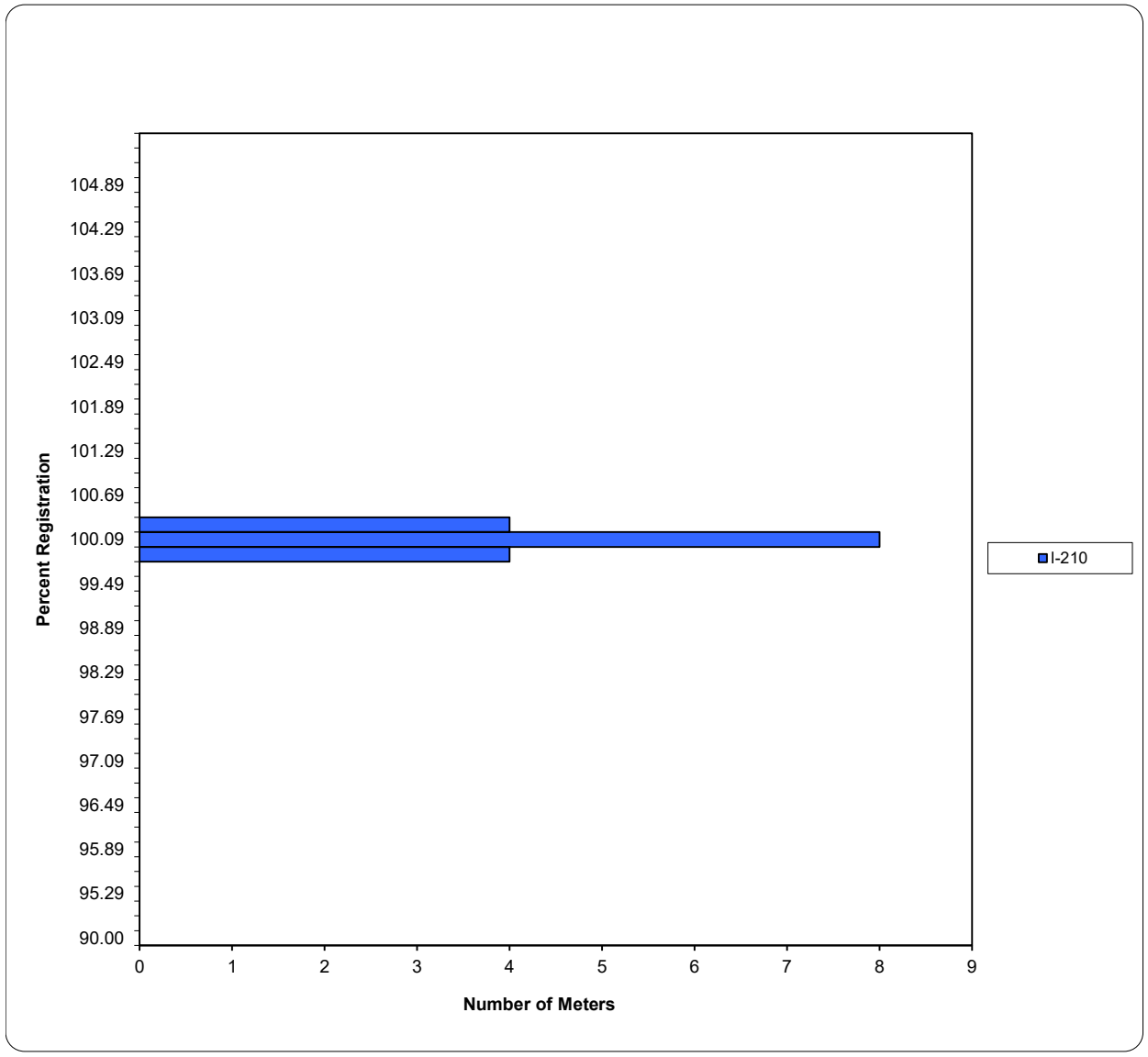
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	2
99.90	100.09	2
100.10	100.29	0
100.30	100.49	2
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: I-70 Weighted Avg.



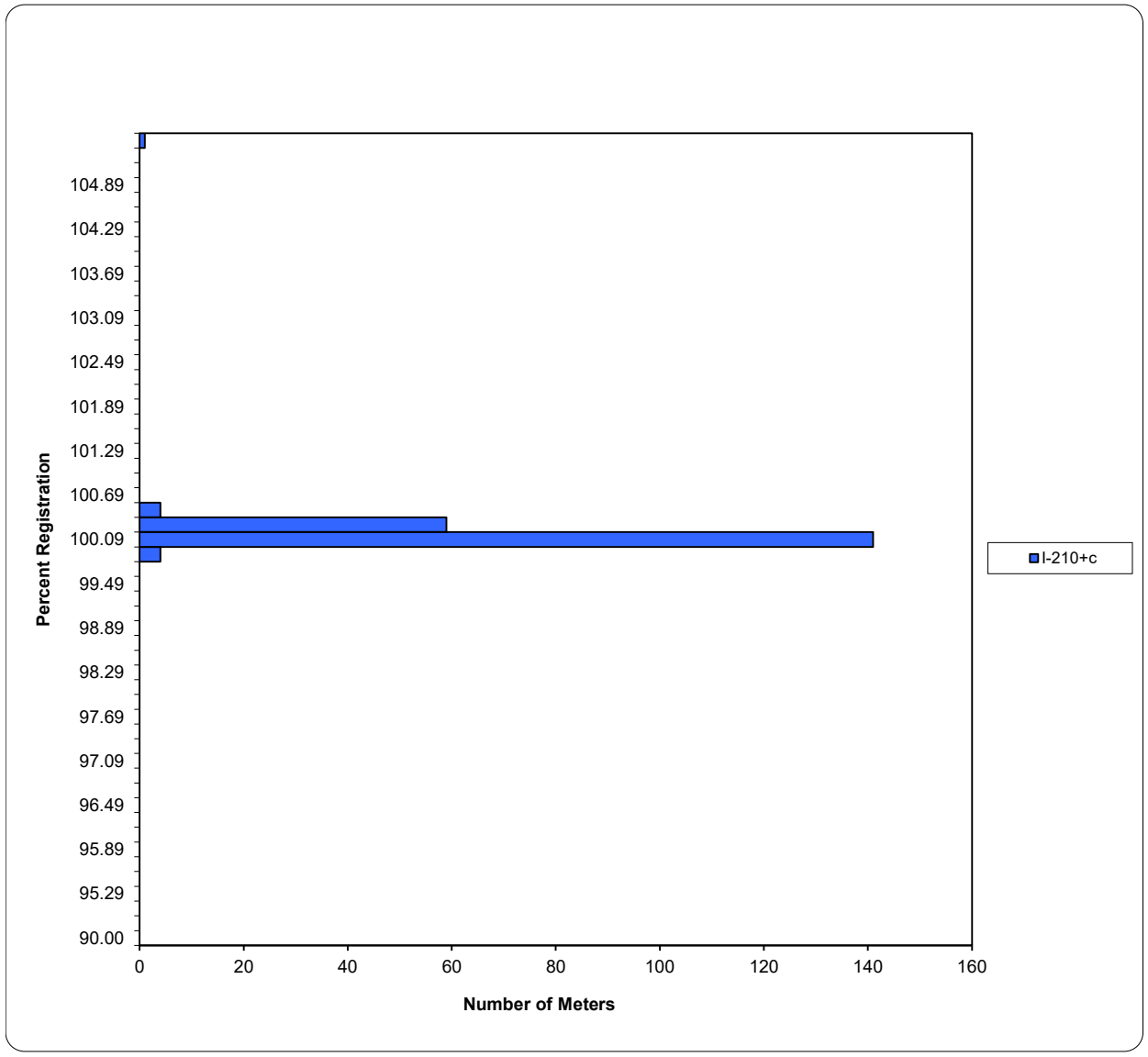
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	1
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	1
99.10	99.29	1
99.30	99.49	2
99.50	99.69	5
99.70	99.89	12
99.90	100.09	12
100.10	100.29	11
100.30	100.49	7
100.50	100.69	0
100.70	100.89	1
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: I-210 Weighted Avg.



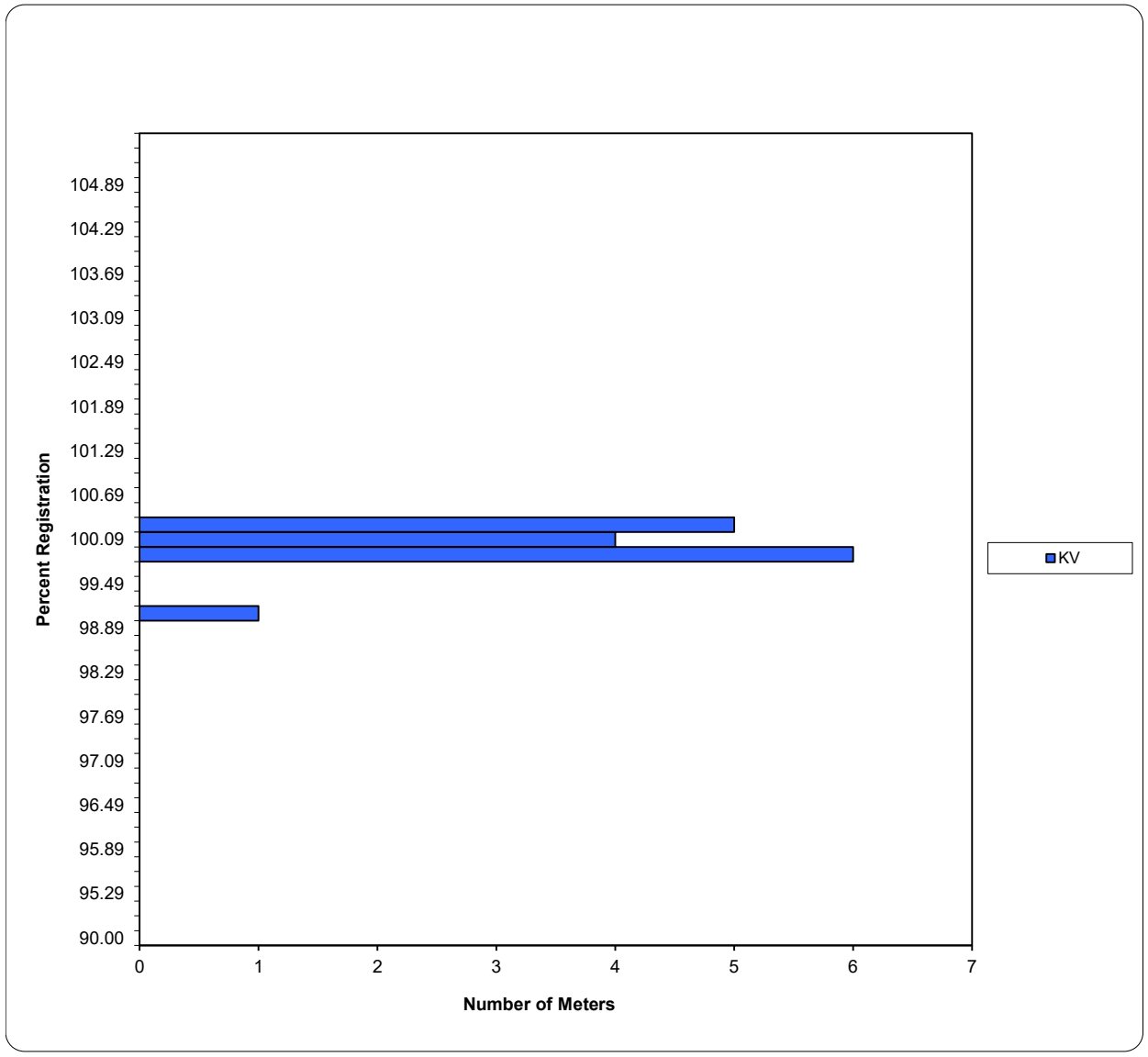
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	4
99.90	100.09	8
100.10	100.29	4
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: I-210+c Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	4
99.90	100.09	141
100.10	100.29	59
100.30	100.49	4
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	1

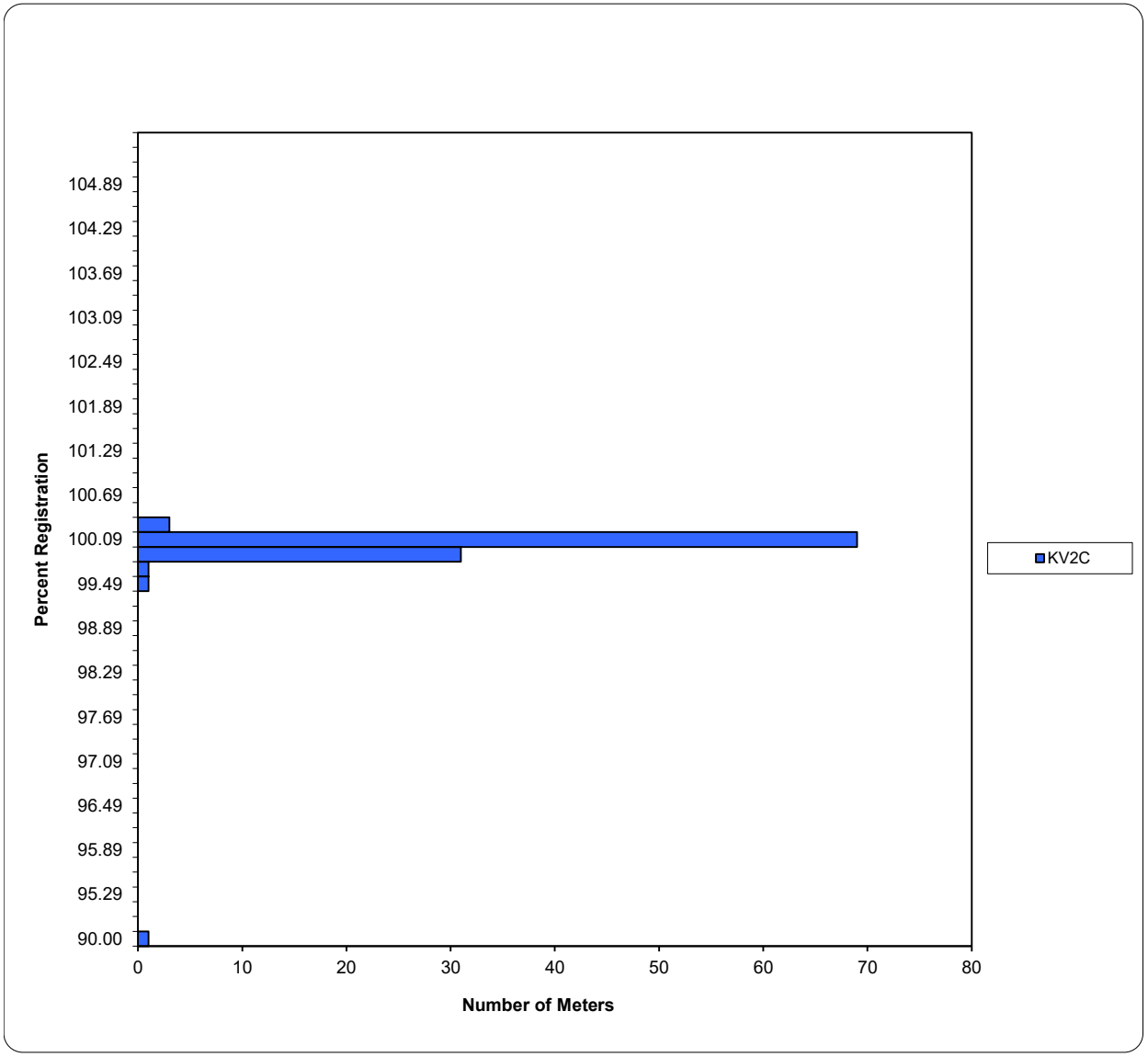
Meter Model Group: KV Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	1
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	6
99.90	100.09	4
100.10	100.29	5
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

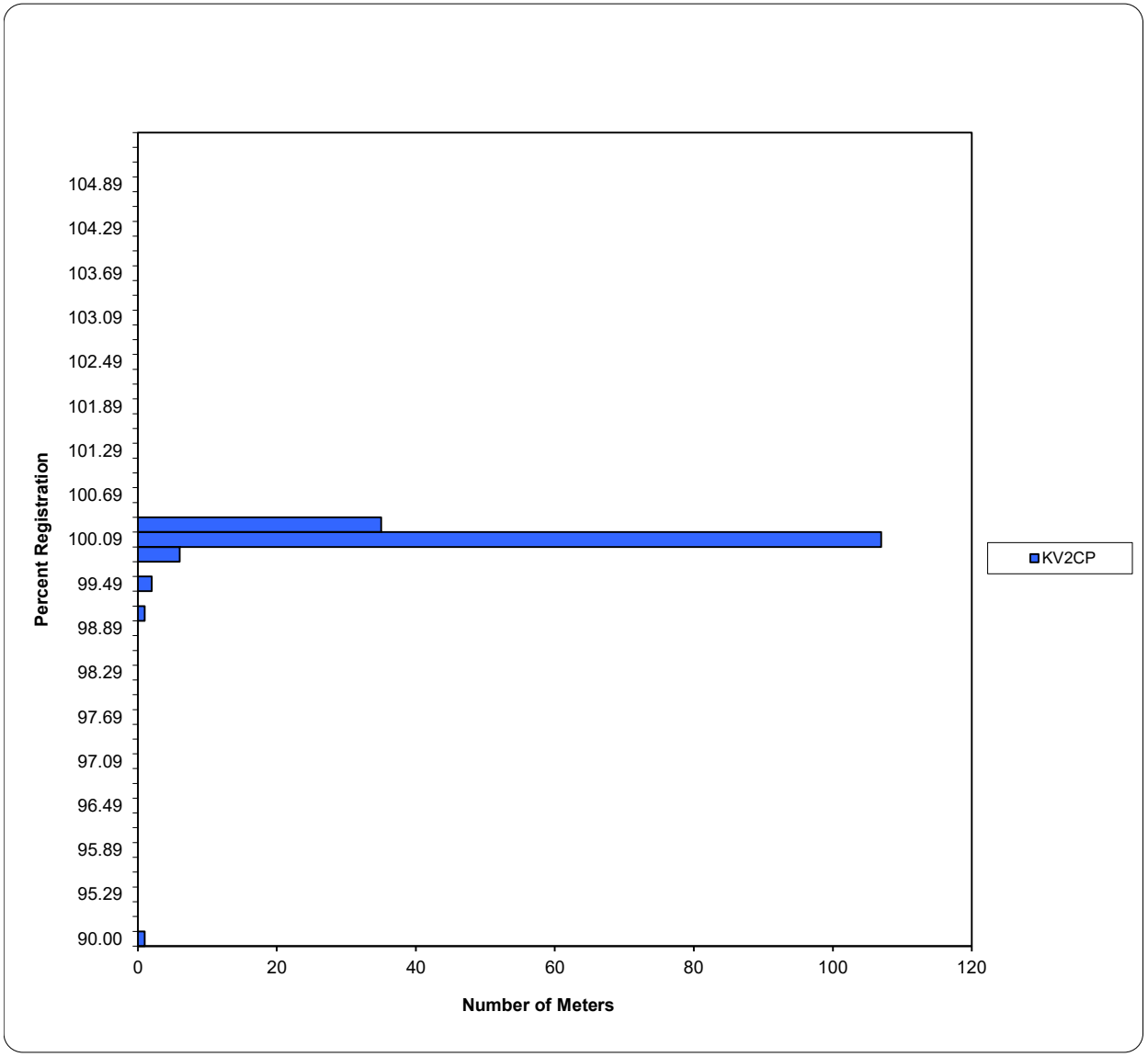
Appendix C
PacifiCorp 2023

Meter Model Group: kV2c Weighted Avg.



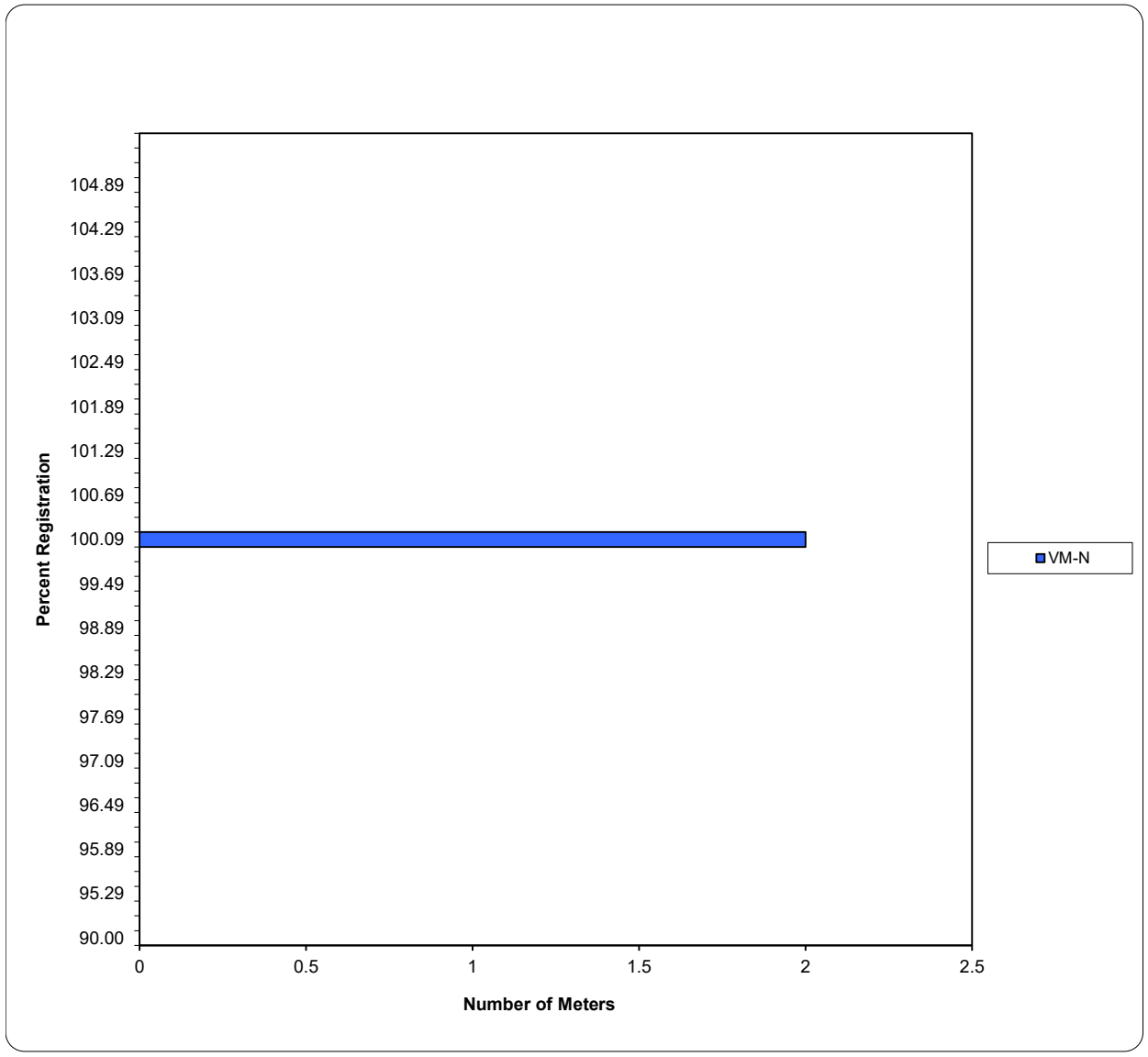
Percent Registration		# of Meters
Low	High	
0.00	90.00	1
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	1
99.50	99.69	1
99.70	99.89	31
99.90	100.09	69
100.10	100.29	3
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: KV2CP Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	1
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	1
99.10	99.29	0
99.30	99.49	2
99.50	99.69	0
99.70	99.89	6
99.90	100.09	107
100.10	100.29	35
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

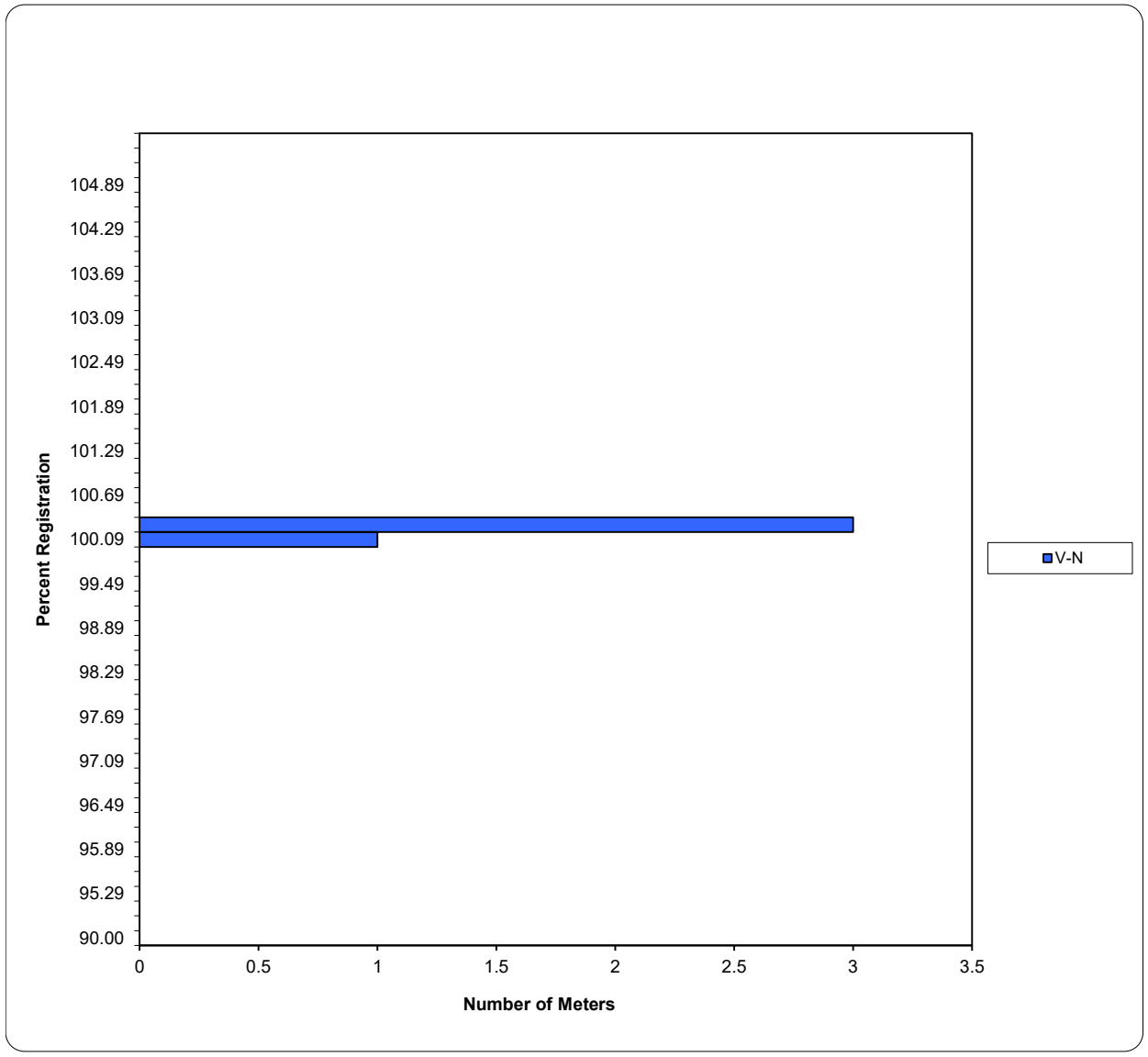
Meter Model Group: VM-N Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	2
100.10	100.29	0
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

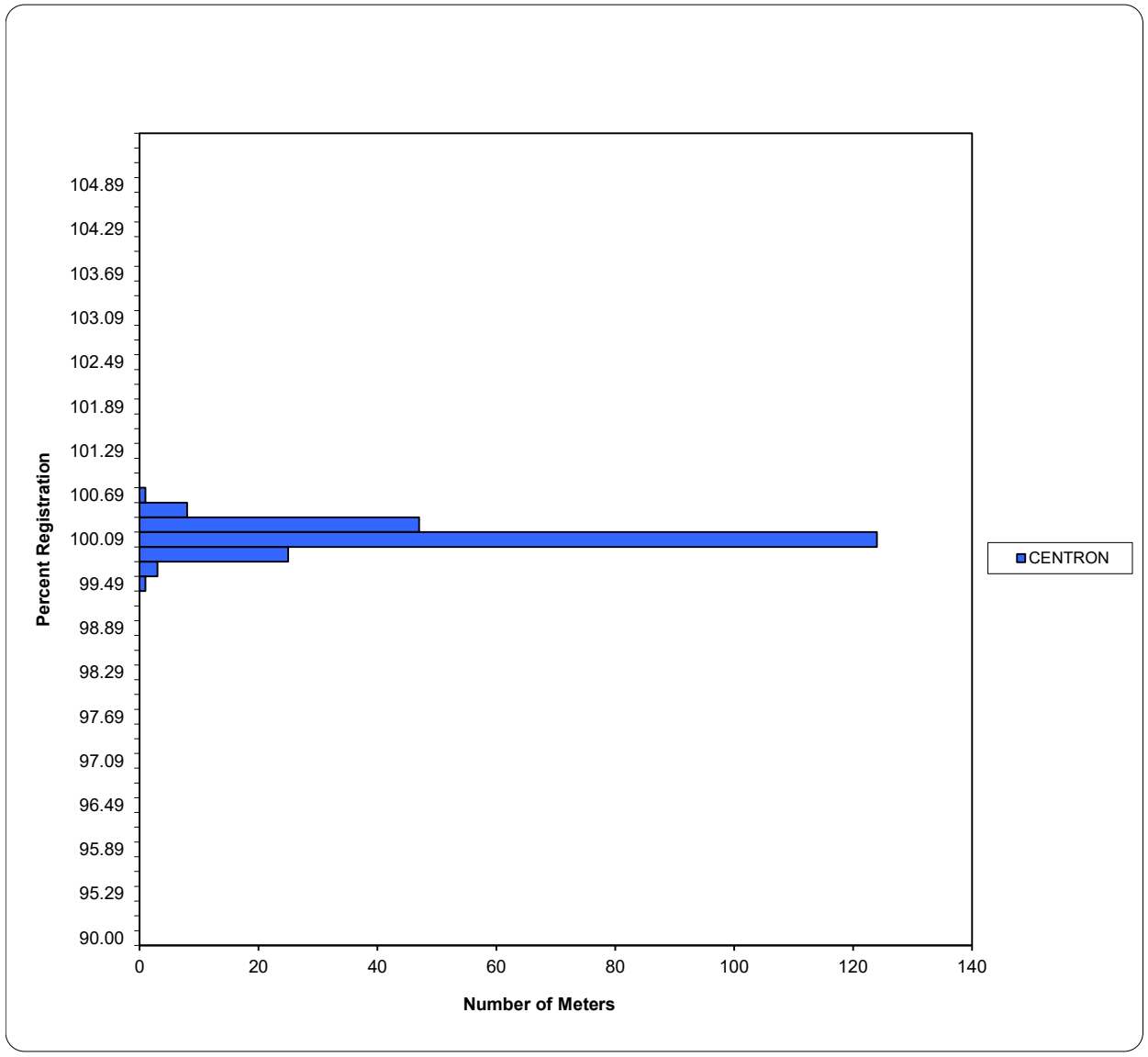
Appendix C
PacifiCorp 2023

Meter Model Group: V-N Weighted Avg.



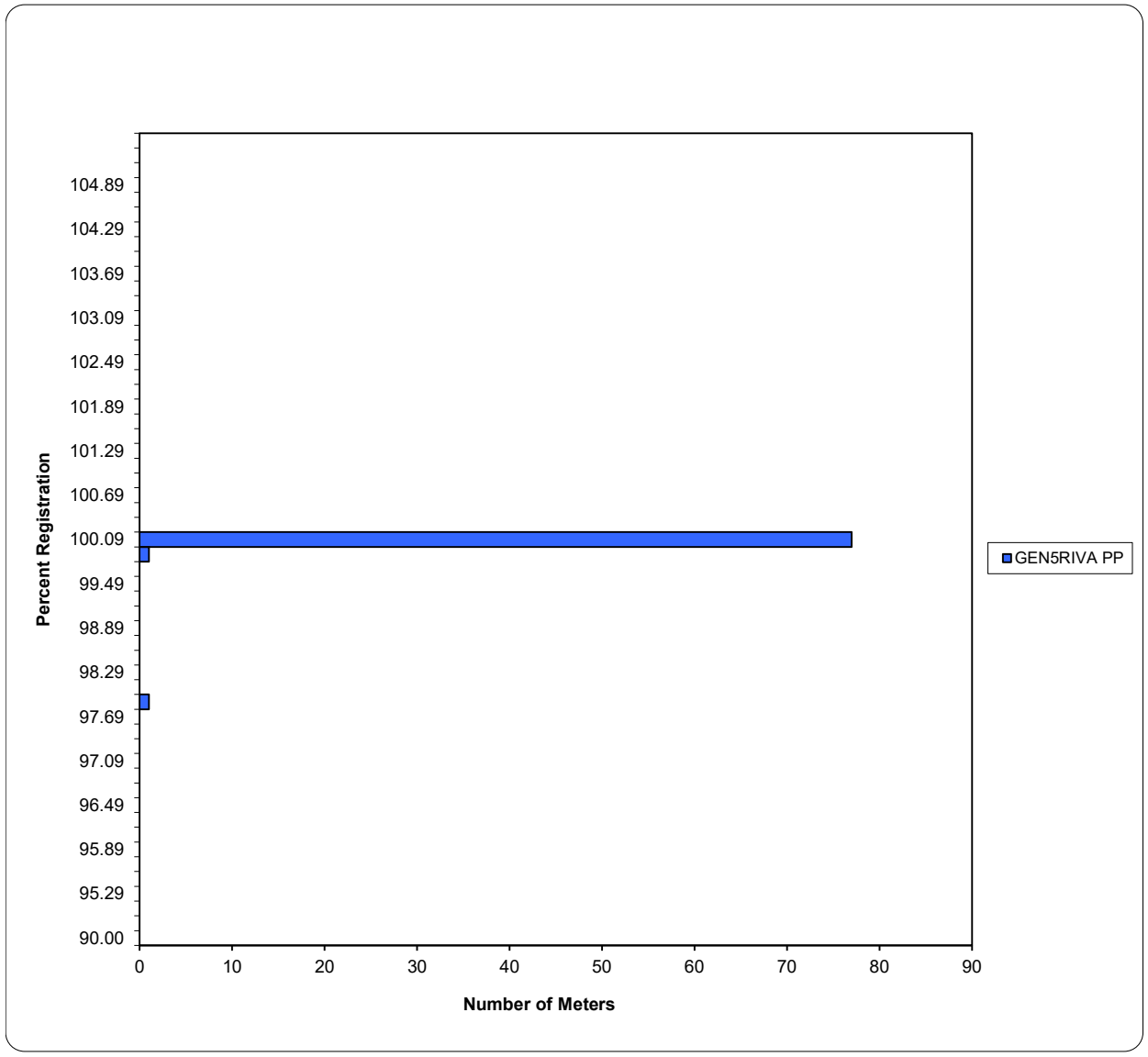
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	1
100.10	100.29	3
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: CENTRON Weighted Avg.



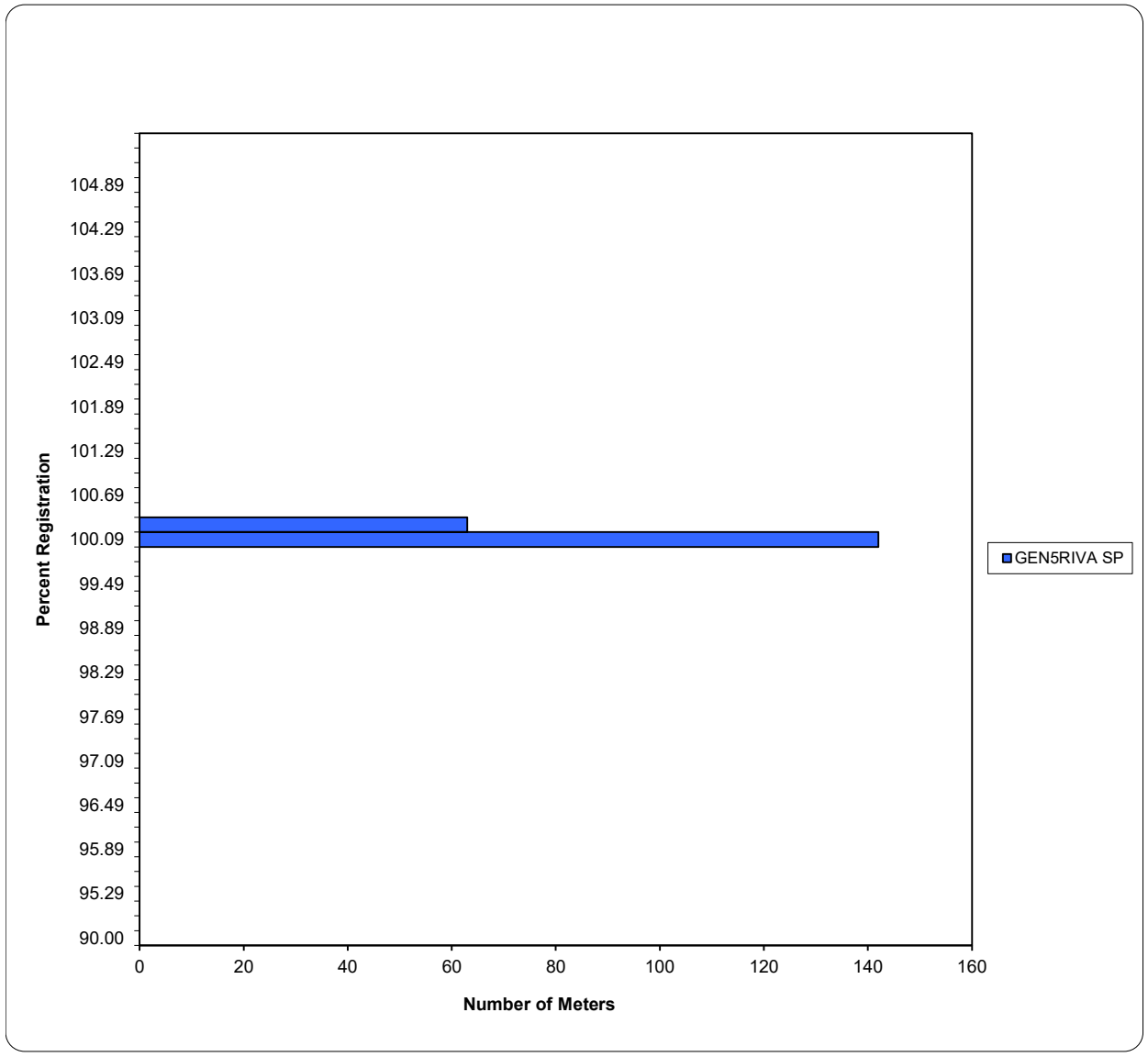
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	1
99.50	99.69	3
99.70	99.89	25
99.90	100.09	124
100.10	100.29	47
100.30	100.49	8
100.50	100.69	1
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: GEN5RIVA PP Weighted Avg.



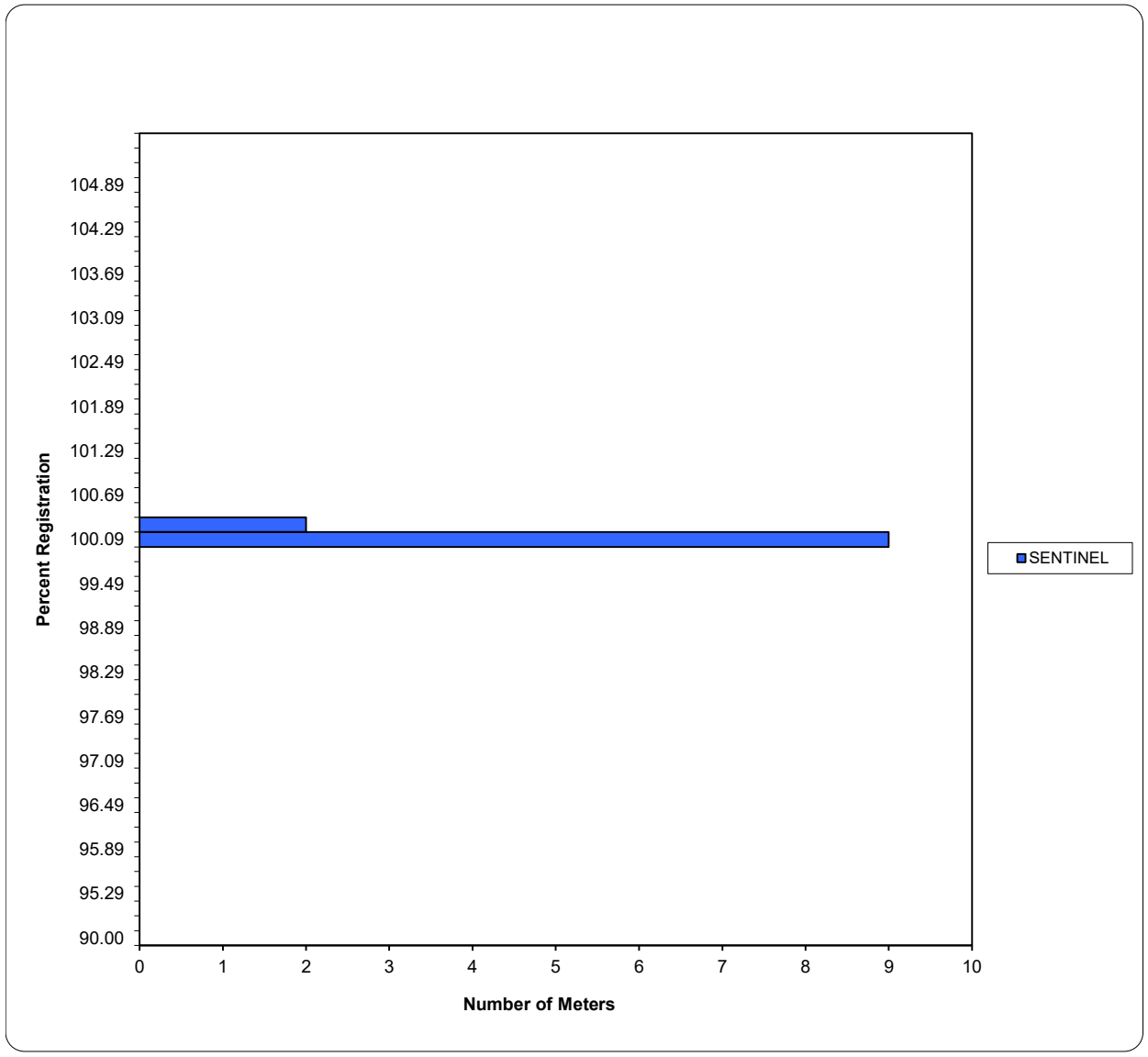
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	1
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	1
99.90	100.09	77
100.10	100.29	0
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: GEN5RIVA SP Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	142
100.10	100.29	63
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

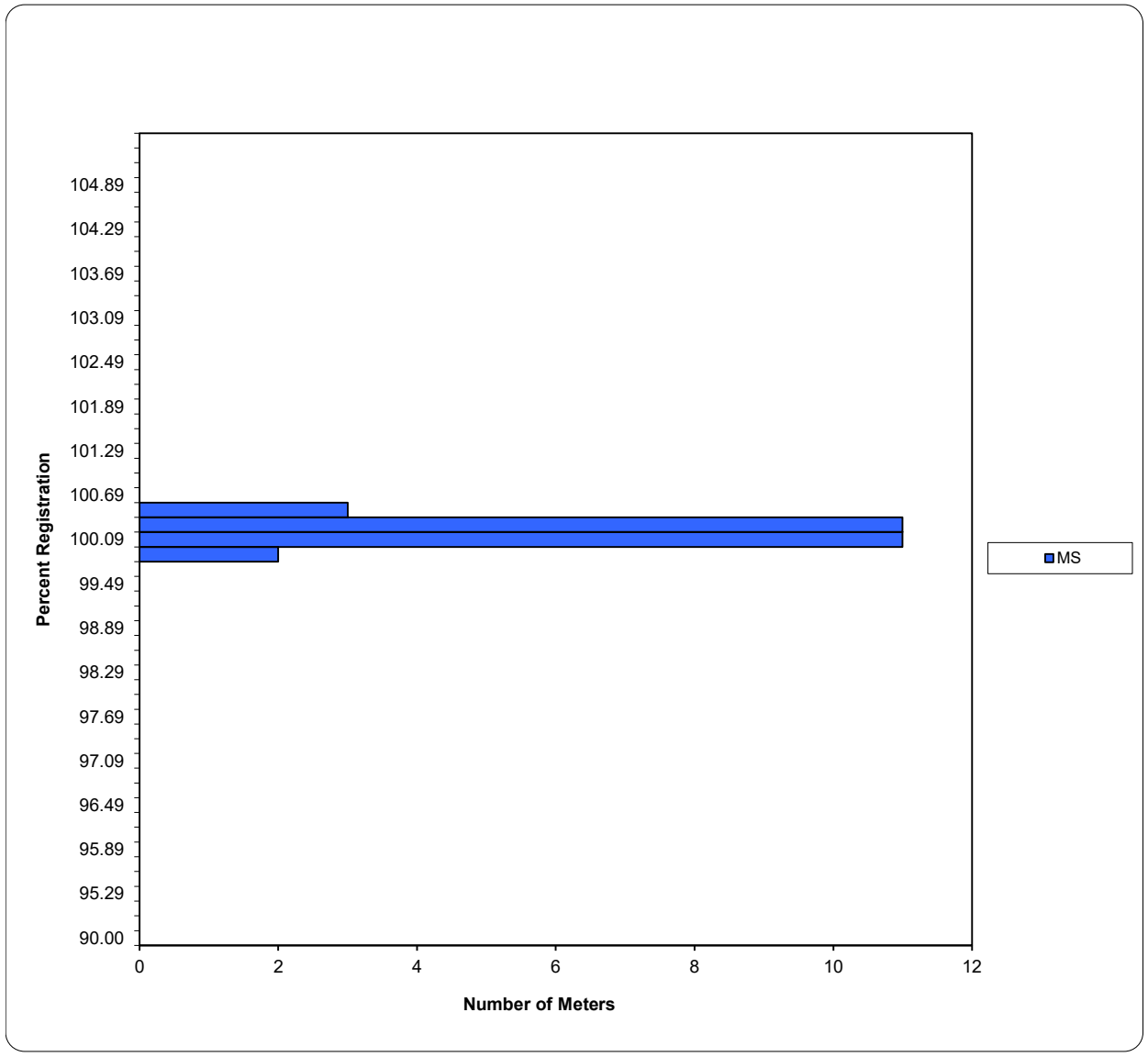
Meter Model Group: Sentinel Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	9
100.10	100.29	2
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

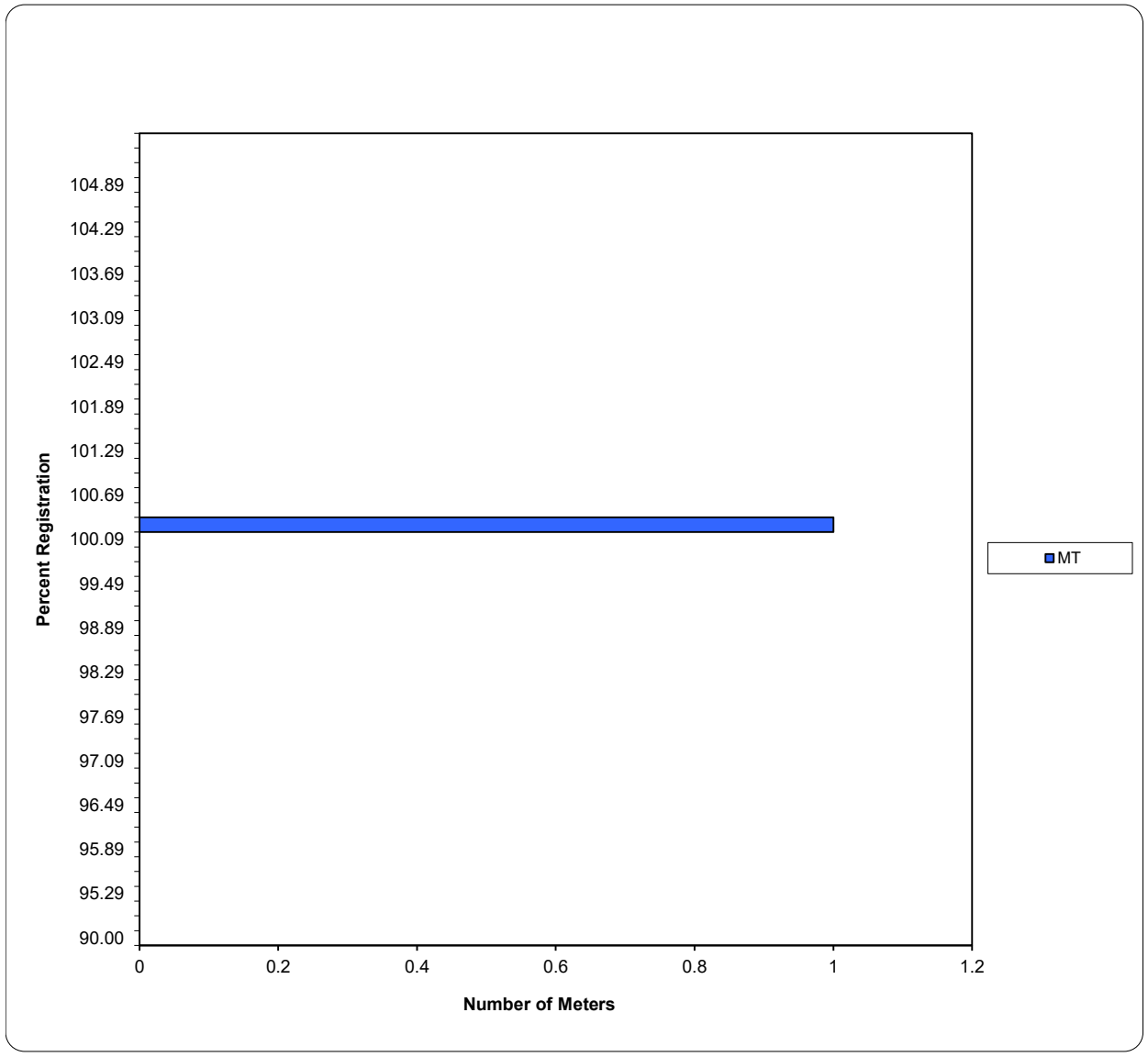
Appendix C
PacifiCorp 2023

Meter Model Group: MS Weighted Avg.



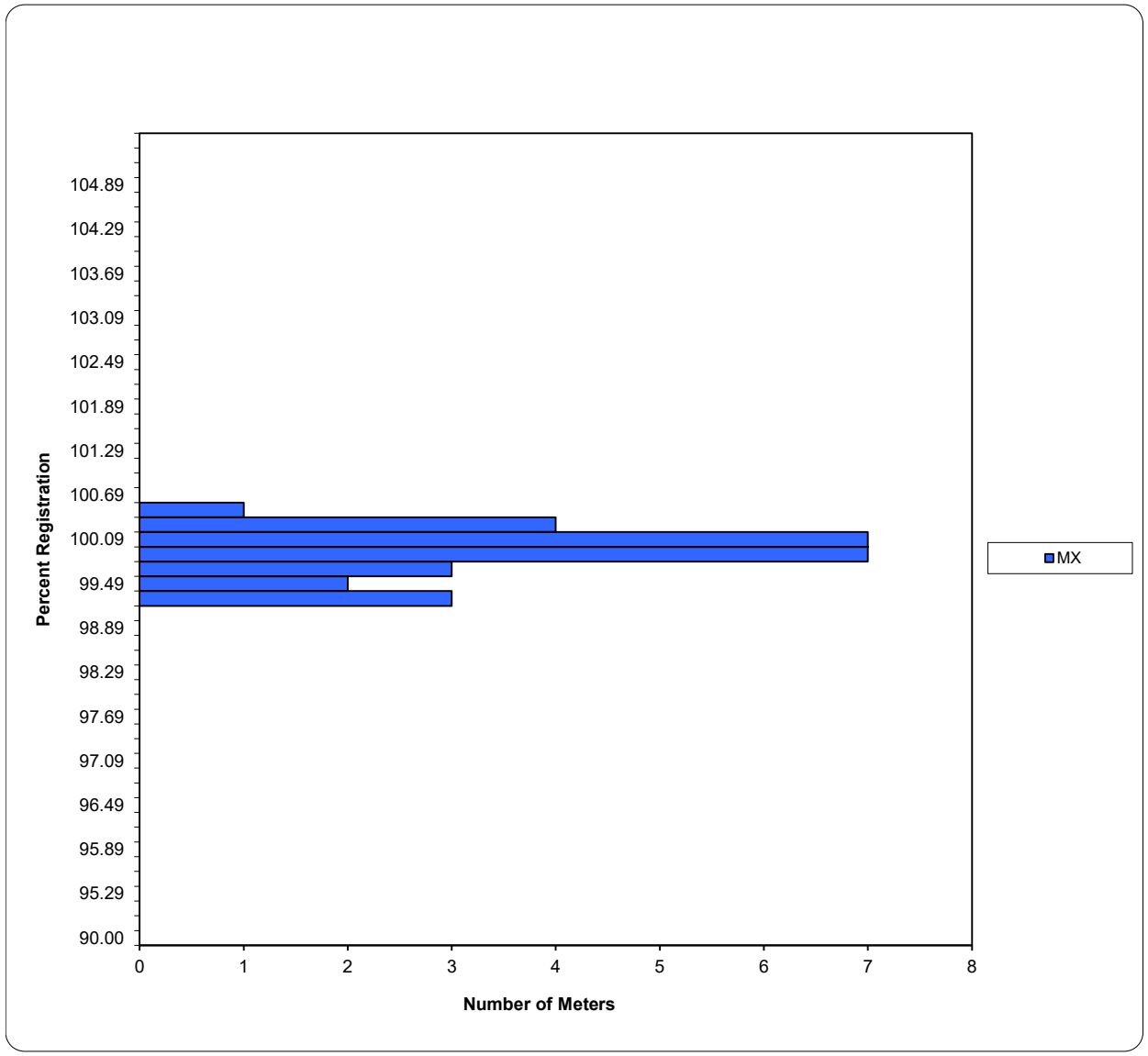
Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	2
99.90	100.09	11
100.10	100.29	11
100.30	100.49	3
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: MT Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	0
100.10	100.29	1
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

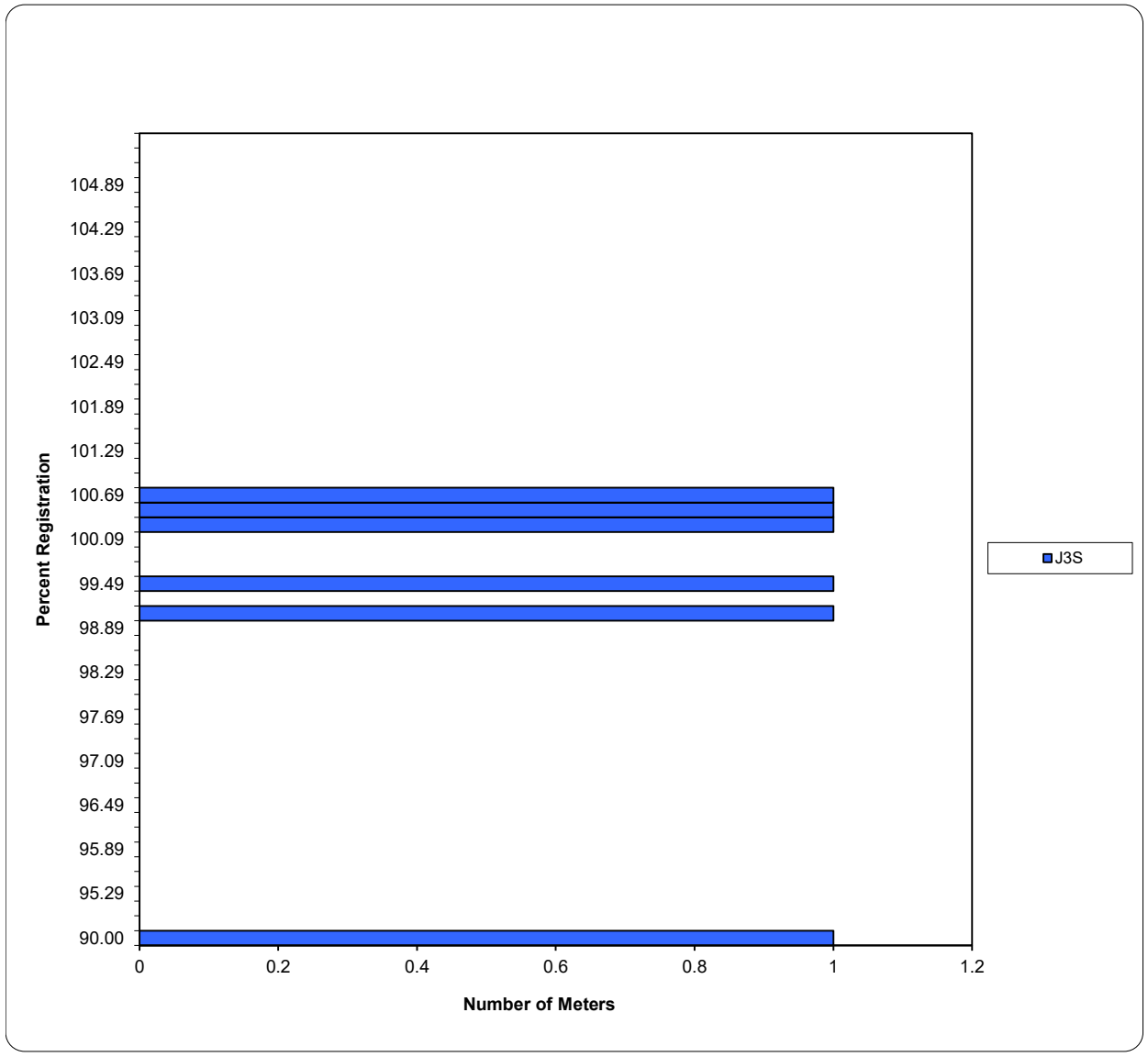
Meter Model Group: MX Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	3
99.30	99.49	2
99.50	99.69	3
99.70	99.89	7
99.90	100.09	7
100.10	100.29	4
100.30	100.49	1
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

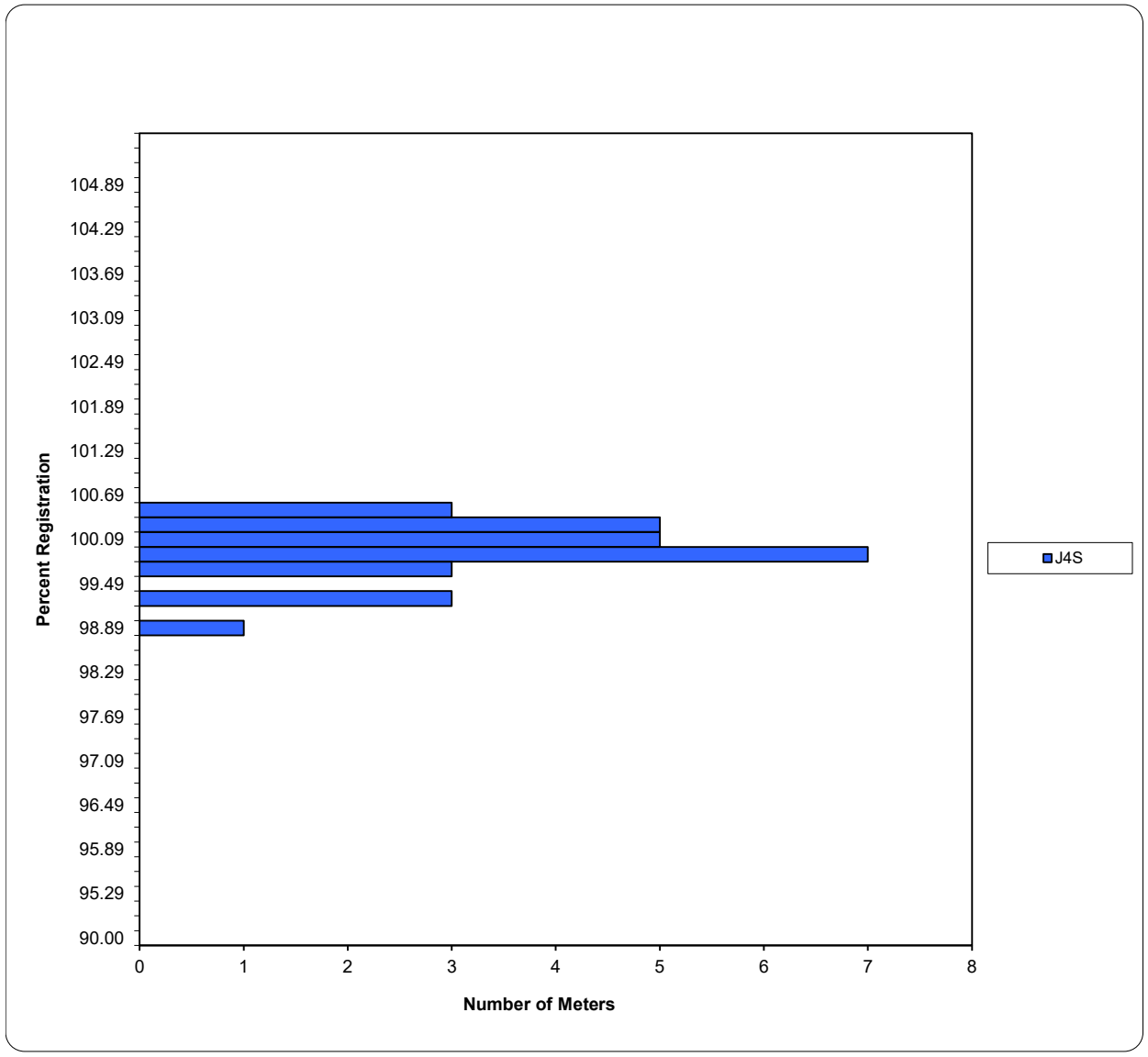
Appendix C
PacifiCorp 2023

Meter Model Group: J3S Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	1
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	1
99.10	99.29	0
99.30	99.49	1
99.50	99.69	0
99.70	99.89	0
99.90	100.09	0
100.10	100.29	1
100.30	100.49	1
100.50	100.69	1
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

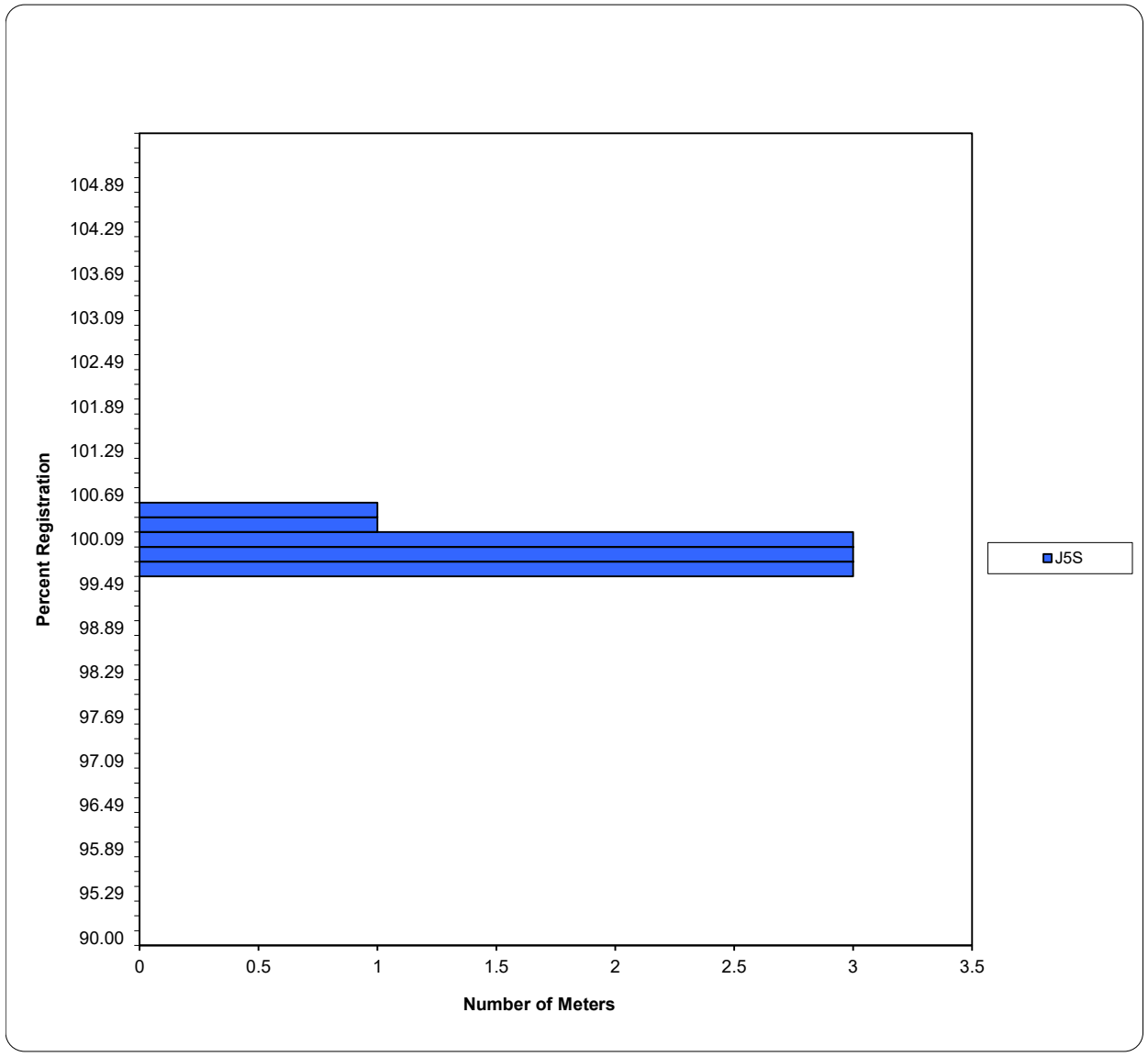
Meter Model Group: J4S Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	1
98.90	99.09	0
99.10	99.29	3
99.30	99.49	0
99.50	99.69	3
99.70	99.89	7
99.90	100.09	5
100.10	100.29	5
100.30	100.49	3
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

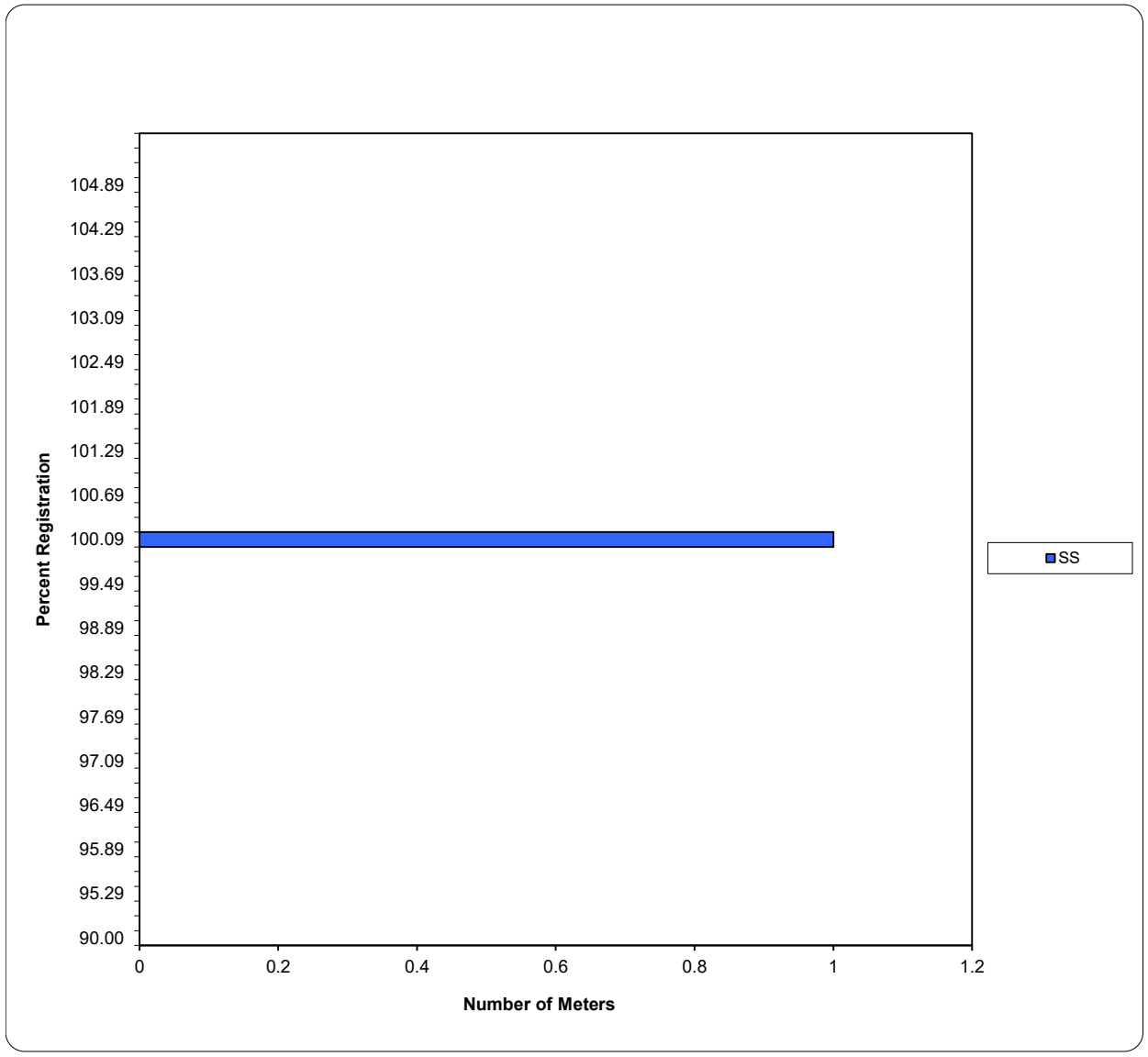
Appendix C
PacifiCorp 2023

Meter Model Group: J5S Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	3
99.70	99.89	3
99.90	100.09	3
100.10	100.29	1
100.30	100.49	1
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Meter Model Group: SS Weighted Avg.



Percent Registration		# of Meters
Low	High	
0.00	90.00	0
90.01	94.99	0
95.00	95.09	0
95.10	95.29	0
95.30	95.49	0
95.50	95.69	0
95.70	95.89	0
95.90	96.09	0
96.10	96.29	0
96.30	96.49	0
96.50	96.69	0
96.70	96.89	0
96.90	97.09	0
97.10	97.29	0
97.30	97.49	0
97.50	97.69	0
97.70	97.89	0
97.90	98.09	0
98.10	98.29	0
98.30	98.49	0
98.50	98.69	0
98.70	98.89	0
98.90	99.09	0
99.10	99.29	0
99.30	99.49	0
99.50	99.69	0
99.70	99.89	0
99.90	100.09	1
100.10	100.29	0
100.30	100.49	0
100.50	100.69	0
100.70	100.89	0
100.90	101.09	0
101.10	101.29	0
101.30	101.49	0
101.50	101.69	0
101.70	101.89	0
101.90	102.09	0
102.10	102.29	0
102.30	102.49	0
102.50	102.69	0
102.70	102.89	0
102.90	103.09	0
103.10	103.29	0
103.30	103.49	0
103.50	103.69	0
103.70	103.89	0
103.90	104.09	0
104.10	104.29	0
104.30	104.49	0
104.50	104.69	0
104.70	104.89	0
104.90	105.00	0
105.01	109.99	0
110.00	∞	0

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Total Company

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Itron	CENTRON	195	DB - Display bad - Electronic	1	0.51%
			OA - Out Of Accuracy	1	0.51%
	J3S	6	OA - Out Of Accuracy	1	16.67%
			OP - Open Pot Coil	1	16.67%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Total Company

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
General Electric/A	KV2C	23	BU - Burned	1	4.35%
			OA - Out Of Accuracy	1	4.35%
	KV2CP	123	FT - Failed Test	2	1.63%
			OA - Out Of Accuracy	1	0.81%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

California					
Manufacturer	Model	Tests	As-Found Condition Codes	**Qty**	**%**

No uniquely defective meters found

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Idaho					
Manufacturer	Model	Tests	As-Found Condition Codes	**Qty**	**%**

No uniquely defective meters found

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Oregon

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Itron	J3S	6	OA - Out Of Accuracy	1	16.67%
			OP - Open Pot Coil	1	16.67%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Oregon

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
General Electric/A	KV2C	7	OA - Out Of Accuracy	1	14.29%
	KV2CP	112	FT - Failed Test	2	1.79%
			OA - Out Of Accuracy	1	0.89%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Utah

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Itron	CENTRON	147	DB - Display bad - Electronic	1	0.68%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Washington

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Itron	CENTRON	24	OA - Out Of Accuracy	1	4.17%
General Electric/A	KV2C	11	BU - Burned	1	9.09%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Wyoming					
Manufacturer	Model	Tests	As-Found Condition Codes	**Qty**	**%**

No uniquely defective meters found

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Total Company

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Itron	CENTRON	52	DB - Display bad - Electronic	2	3.85%
Elster/Honeywell	ALPHA	26	OA - Out Of Accuracy	1	3.85%
General Electric/A	KV	22	FT - Failed Test	1	4.55%
	KV2C	1352	ER - Error Code Problem	1	0.07%
			OA - Out Of Accuracy	6	0.44%
			OP - Open Pot Coil	1	0.07%
	KV2CP	333	ST - Stopped Meter	1	0.30%
Landis & Gyr	Elite	26	OA - Out Of Accuracy	1	3.85%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

California					
Manufacturer	Model	Tests	As-Found Condition Codes	**Qty**	**%**

No uniquely defective meters found

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Idaho

Manufacturer	Model	Tests	As-Found Condition Codes	**Qty**	**%**

No uniquely defective meters found

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Oregon

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
General Electric/A	KV2C	590	OA - Out Of Accuracy	2	0.34%
	KV2CP	278	ST - Stopped Meter	1	0.36%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Oregon

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Landis & Gyr	Elite	7	OA - Out Of Accuracy	1	14.29%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Utah

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Itron	CENTRON	7	DB - Display bad - Electronic	1	14.29%
General Electric/A	KV2C	212	OA - Out Of Accuracy	2	0.94%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Washington

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
Itron	CENTRON	14	DB - Display bad - Electronic	1	7.14%
Elster/Honeywell	ALPHA	3	OA - Out Of Accuracy	1	33.33%
General Electric/A	KV	5	FT - Failed Test	1	20.00%
	KV2C	277	ER - Error Code Problem	1	0.36%
			OA - Out Of Accuracy	1	0.36%
			OP - Open Pot Coil	1	0.36%

Appendix D_1

PacifiCorp
Calendar Year 2023
Uniquely Defective/As-Found Condition Codes
Sample Meter Tests

Wyoming

Manufacturer	Model	Tests	As-Found Condition Codes	Qty	%
General Electric/A	KV2C	259	OA - Out Of Accuracy	1	0.39%

Appendix E
PacifiCorp 2023
Scheduled Meter Test Counts

TOTAL COMPANY

Maintenance Class Code	Scheduled	Completed	% Completed
2yr	624	624	100.0%
8yr	1209	1209	100.0%
16yr	217	217	100.0%
Sample	1075	1075	100.0%
Totals	3125	3125	100.0%

CALIFORNIA

Maintenance Class Code	Scheduled	Completed	% Completed
2yr	4	4	100.0%
8yr	50	50	100.0%
16yr	5	5	100.0%
Sample	69	69	100.0%
Totals	128	128	100.0%

IDAHO

Maintenance Class Code	Scheduled	Completed	% Completed
2yr	26	26	100.0%
8yr	0	0	N/A
16yr	29	29	100.0%
Sample	137	137	100.0%
Totals	192	192	100.0%

OREGON

Maintenance Class Code	Scheduled	Completed	% Completed
2yr	117	117	100.0%
8yr	734	734	100.0%
16yr	72	72	100.0%
Sample	483	483	100.0%
Totals	1406	1406	100.0%

UTAH

Maintenance Class Code	Scheduled	Completed	% Completed
2yr	334	334	100.0%
8yr	0	0	N/A
16yr	1	1	100.0%
Sample	283	283	100.0%
Totals	618	618	100.0%

Appendix E
PacifiCorp 2023
Scheduled Meter Test Counts

WASHINGTON

Maintenance Class Code	Scheduled	Completed	% Completed
2yr	16	16	100.0%
8yr	254	254	100.0%
16yr	44	44	100.0%
Sample	50	50	100.0%
Totals	364	364	100.0%

WYOMING

Maintenance Class Code	Scheduled	Completed	% Completed
2yr	127	127	100.0%
8yr	171	171	100.0%
16yr	66	66	100.0%
Sample	53	53	100.0%
Totals	417	417	100.0%

Appendix F

2023 PacifiCorp

Meter Retirement Report

Category & Reason	Meter Model	Serial # Range		Inservice 12/31/2022		Retired		Inservice 12/31/2023
Failed Sample Test Program - failed 2 consecutive years								
Failed Sample	Westinghouse D5	All		190	-	29	=	161
Failed Sample	General Electric EV	All		100	-	94	=	6
			Total	290		123		167
Special Problem - Open potential coil, guide pin, gears, or other manufacture defect								
Manuf Defect	Westinghouse D4, 1-ph	68,800,000-71,999,999		5	-	5	=	0
Potential Coil	Sangamo J3	All		39	-	4	=	35
			Total	44		9		35
			Grand Total	**334**	-	**132**	=	**202**

Appendix G

PacifiCorp 2022

PacifiCorp Engineering Supporting Policy and Standards

Select Company Metering Standards

Metering Operations Practices & Procedures

Chapter 3 – Reference Standards

- 3.1 – Watthour Reference Standards
  - 3.1.1 – Annual Watthour Transport Standard Verification
  - 3.1.2 – Quarterly Intercomparison of the Basic Reference and Transport Standards
  - 3.1.3 – Quarterly Certification of the Field Transfer Standard
  - 3.1.4 – PacifiCorp Watthour Standard Procedure

Metering Standards and Engineering Policies

- Policy No. 052 - Meter Maintenance and Testing Policy

Watthour Reference Standards

1 Scope

This document establishes PacifiCorp's policy on the certification of revenue metering watthour reference standards.

2 Definitions

The following definitions and acronyms pertain to this document:

Basic Reference Standard: PacifiCorp's master reference standard. PacifiCorp currently uses Radian Research, Inc.'s RD-22
DUT: Device under test
Field Standard: A watthour standard mounted within an automatic test board or used with portable load boxes
Field Transfer Standard: A watthour standard that is certified quarterly with the basic reference standard
NIST: National Institute of Standards and Technology
NIST Traceable Independent Laboratory: An independent standards laboratory that is able to provide documental traceability to NIST e.g. Radian Research, Inc.
Transport Standard: A standard sent off annually to a NIST traceable independent laboratory to provide traceability from PacifiCorp's reference standards to NIST. PacifiCorp currently uses Radian Research, Inc.'s RD-23

3 References

ANSI C12.1 *Code for Electricity Metering*

4 General

The regulatory bodies of all states served by PacifiCorp have mandated that all meter tests be traceable to the National Institute of Standards and Technology (NIST). Documentation must be maintained by the utility containing the following items:

1) Description of test standards and meter testing equipment
2) Description of methods employed to ascertain and maintain the accuracy of the test standards and meter testing equipment, including the frequency of such tests

Records shall be maintained showing the date when each watthour standard was certified. Any watthour standard that fails to meet the accuracy requirements as outlined in this document shall be returned to the manufacturer.

The certification process compares the readings from a watthour standard and the device under test (DUT) subjected to the same voltages and currents. A watthour standard used to certify equipment must be of higher accuracy than the DUT.

5 Basic Reference Standard

5.1 General

The basic reference standard is defined in the latest edition of ANSI C12.1, which is PacifiCorp's primary certification reference standard and directly traceable to NIST. The basic reference standard consists of a primary reference standard or standards that are intercompared quarterly to trend their stability. The long-term history will indicate any degradation of the basic reference standard. This is the practice recommended by NIST.

5.2 Frequency of Certification

PacifiCorp will certify its basic reference standard annually with its transport standard upon return from NIST or a NIST traceable independent laboratory.

5.3 Accuracy

The accuracy of the basic reference standard shall have an error less than +/- 0.01%.

5.4 Certification Points

Certification points shown in Table 1 shall be used to certify the basic reference standard. All phase angles in Table 1 are lagging phase angles.

Table 1 – Basic reference standard certification points

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

6 Transport Standard

6.1 General

The transport standard is defined in the latest edition of ANSI C12.1, which is used as an engineering transport standard. This standard does not leave the facility except to be transported back to NIST or a NIST traceable independent laboratory for annual certification and calibration (if necessary). The transport standard provides the traceability from PacifiCorp's reference standards to NIST. The transport standard is certified with the basic reference standard quarterly.

6.2 Frequency of Certification

The transport standard shall be sent to either NIST or a NIST traceable independent laboratory annually to be tested against the basic reference standard(s) of either NIST or a NIST traceable independent laboratory.

6.3 Accuracy

The portable watthour standard shall have an error less than +/- 0.01%.

6.4 Certification Points

Certification points shown in Table 2 shall be used to certify the transport watthour standard. All phase angles in Table 2 are lagging phase angles.

Table 2 – Transport reference standard certification points

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

7 Field Transfer Standard

7.1 General

A field transfer standard is a traveling watthour standard, which is used to certify all other field standards.

7.2 Frequency of Certification

Field transfer standards shall be certified quarterly against the basic reference standard.

7.3 Accuracy

The field transfer standard shall have an error less than +/- 0.02%.

7.4 Certification Points

Certification points shown in Table 3 shall be used to certify the portable watthour standard. All phase angles in Table 3 are lagging phase angles.

Table 3 – Portable reference standard certification points

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

8 Field Standard

8.1 General

A field standard is used to test revenue, substation, intertie and generation meters. These watthour standards are either mounted within field automatic test boards or with portable load boxes.

8.2 Frequency of Certification

Field standards shall be certified at least annually against the field transfer standard.

8.3 Accuracy

The field watthour standard shall have an error less than ± 0.04% or 0.05% depending on the reference standard located in the automatic test boards e.g. WECO test boards.

8.4 Calibration

Calibration points shown in Table 4 shall be used to certify the field watthour standards.

Table 4 – Field standard certification points

	Voltage & Phase Angle							
	120		240		277		480	
Amps	0°	60°	0°	60°	0°	60°	0°	60°
0.25								
0.5								
1.5								
2.5								
3								
5								
15								
30								
50								

9 Records Retention

PacifiCorp shall maintain a record of all the watthour standards including certification dates, results, and the person performing the certification. These records shall be maintained for a minimum of seven (7) years as required by PacifiCorp's Record Management department. However, it is at the discretion of the Metering Assets and Technology department to decide whether to retain the aforementioned records after seven (7) years. Any electronic records/results shall be kept indefinitely i.e. as long as there is memory to store these records.

Annual Watthour Transport Standard Verification

1 Scope

This document covers the annual verification of PacifiCorp's basic reference standard with PacifiCorp's transport standard sent to NIST or a NIST traceable independent laboratory using the RS-703A Automated Calibration System.

2 Definition

The following definitions and acronyms pertain to this document:

Basic Reference Standard: PacifiCorp's master reference standard. PacifiCorp currently uses Radian Research, Inc.'s RD-22
NIST: National Institute of Standards and Technology
NIST Traceable Independent Laboratory: An independent standards laboratory that is able to provide documental traceability to NIST
RS-703A System: Radian RS-703A Automated Calibration System
Transport Standard: A standard sent off annually to a NIST traceable independent laboratory to provide traceability from PacifiCorp's reference standards to NIST. PacifiCorp currently uses Radian Research, Inc.'s RD-23

3 Introduction

Every year, PacifiCorp shall first run its own tests on the transport standard using the same test points used by a NIST traceable independent laboratory as shown below in Table 1. All phase angles in Table 1 are lagging phase angles.

Next, PacifiCorp shall send a transport standard to a NIST traceable independent laboratory annually, to conduct accuracy certification tests. These tests will certify within an acceptable level of uncertainty that the registration of the transport standard is as expected within the limits stated by the manufacturer of the standard. This process also provides traceability of the company's watthour reference standard to the national watthour reference standard.

After the transport standard tests are completed by a NIST traceable independent laboratory, the transport standard is returned to PacifiCorp. PacifiCorp then runs its own test on the transport standard using the same test points used by the certifying laboratory, against PacifiCorp's basic reference standard shown in Table 1. All phase angles in Table 1 are lagging phase angles.

Table 1 – Test points

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

4 Tools, Materials, and Equipment

The following tools, materials, and equipment are used to perform the intercomparison tests:

- Basic reference standard (RD-22)
- Transport reference standard (RD-23)
- RS-703A system
- BNC cables
- Radian Research, Inc. potential and current cables
- Auxiliary power cables for Radian Research, Inc. reference standards

5 Procedure

Sections 5.1 to 5.3 are the procedures that pertain to the annual watthour transport verification. Figure 1 shows the basic equipment setup of the basic reference and transport standards.

5.1 Equipment Setup

Follow the steps in Table 2 to set up the equipment.

Table 2 – Equipment setup

Step	Action
1	Ensure that auxiliary power is being provided to both the basic reference standard and transport standard.
	Note: The basic reference standard should not be disconnected or turned off unless deemed necessary.
2	A. Connect the BNC cable from channel 1 of the RS-703A data collection module to the output of the basic reference standard. B. Connect the BNC cable from channel 2 of the RS-703A data collection module to the output of the transport standard.
3	Connect the current leads in series from the current amplifier of the RS-703A to the basic reference and transport standards.
4	Connect the potential leads from the voltage amplifier of the RS-703A to the potential input of the basic reference standard. Jumper from the potential input of the basic reference standard to the transport standard.
	Note: Ensure polarity is correct. It is important to stay consistent with the polarity or the test results will be incorrect.
5	Select 'Watthour' display on both the basic reference standard and the transport standard.

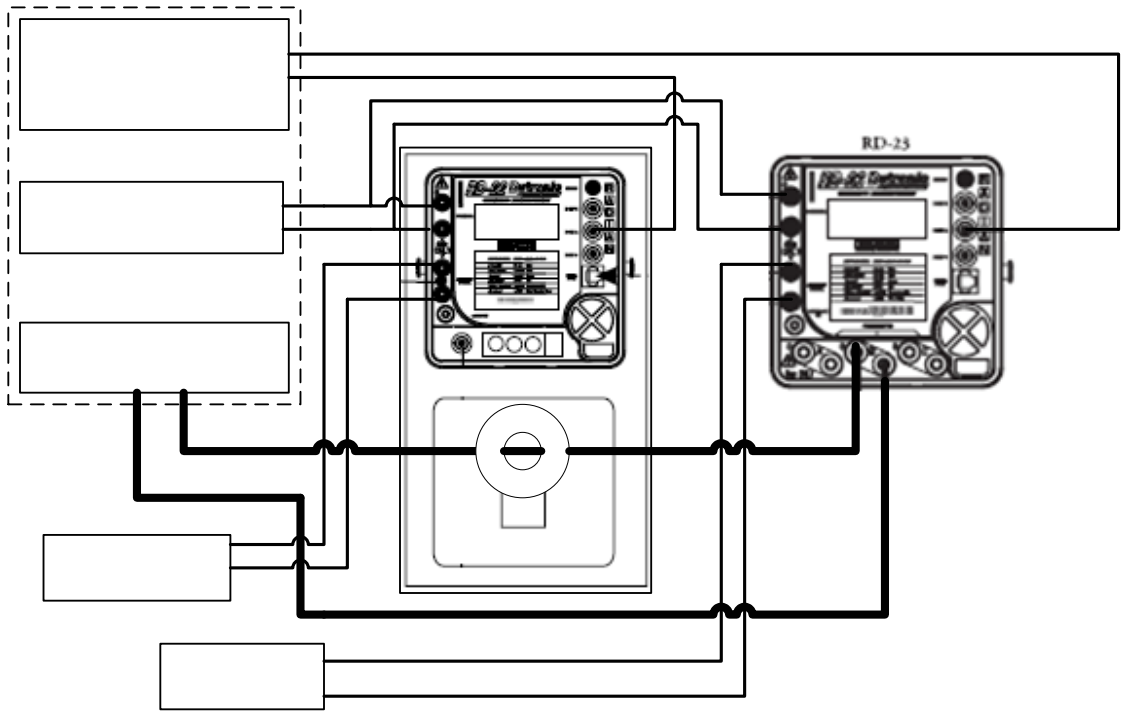


Figure 1 – Equipment setup to test transport standard

CAUTION

High voltage (up to 480V) is present at the terminals of the watthour standards.

5.2 Test Setup

Follow the steps in Table 3 to set up the verification test.

Table 3 – Test setup

Step	Action
1	Turn on the RS-703A system power supply with the appropriate key.
	Note: Energize the RS-703A for at least 30 minutes as suggested by Radian Research, Inc.
2	A. Turn the computer on. B. Double click on the 'RS-703A Control Program' icon located on the desktop.
3	A. On the 'Channel Table' screen, appropriately select the channel such that the devices under test are matched with their respective channels. B. Enter serial number of the devices under test accordingly.
	Note: For example, channel 1 and channel 2 should always be used for the basic reference standard and transport standard, respectively.
4	Make sure that the basic reference standard is used as the master reference standard. Do so, by making sure 'R1' on the 'Channel Table' screen is set to 'Reference' and check the boxes based on the channels of the devices under test. Leave 'R2' and 'R3' as 'None'.

5.3 Performing the Test

Follow the steps in Table 4 to perform the test on the reference standards.

Table 4 – Performing the test

Step	Action
1	Click on 'Open a Test' icon and select 'Whr - MOPP Cert. Points'.
	Note: A screen will pop up with the test sheet. Leave everything as is. There should not be any changes made to the test sheet.
2	On the test sheet, click on 'Run'. This will begin the test.
3	Upon completion of the test, verify that the percent error values for the basic reference and transport standards are within its worst case accuracy.
	Note: Basic reference standard worst case accuracy: ± 0.01% Transport standard worst case accuracy: ± 0.01%
4	Print two copies of the test results. File one of the copies in the file cabinet in the laboratory and place the other copy in the black tray for the meter engineer.

6 Records Retention

PacifiCorp shall maintain a record of all the watthour standards including certification dates, results, and the person performing the certification. These records shall be maintained for a minimum of seven (7) years as required by PacifiCorp's Record Management department. However, it is at the discretion of the Metering Assets and Technology department to decide whether to retain the aforementioned records after seven (7) years. Any electronic records/results shall be kept indefinitely i.e. as long as there is memory to store these records.

Quarterly Intercomparison of the Basic Reference and Transport Standards

1 Scope

This document covers the procedure for quarterly intercomparison of the basic reference and transport standards using the Radian RS-703A Automated Calibration System to determine the stability of the two reference standards.

2 Definition

The following definitions and acronyms pertain to this document:

NIST: National Institute of Standards and Technology
NIST Traceable Independent Laboratory: An independent standards laboratory that is able to provide documental traceability to NIST
RS-703A System: Radian RS-703A Automated Calibration System
Basic Reference Standard: PacifiCorp's master reference standard. PacifiCorp currently uses Radian Research, Inc.'s RD-22
Transport Standard: A standard sent off annually to a NIST traceable independent laboratory to provide traceability from PacifiCorp's reference standards to NIST. PacifiCorp currently uses Radian Research, Inc.'s RD-23

3 Introduction

Meter Engineering shall conduct an intercomparison of the basic reference standard against the transport standard quarterly. Conducting a quarterly intercomparison between the basic reference and transport standards will aid in determining the stability of the aforementioned reference standards. If one or both of the reference standards are found to be drifting out of calibration, appropriate action shall be taken. Typically this requires returning the drifting standard(s) to the manufacturer for inspection.

4 Tools, Materials, and Equipment

The following tools, materials, and equipment are used to perform the intercomparison tests:

- Basic reference standard (RD-22)
- Transport reference standard (RD-23)
- RS-703A system
- BNC cables
- Radian Research, Inc. potential and current cables
- Auxiliary power cables for Radian Research, Inc. reference standards

5 Procedures

Sections 5.1 to 5.3 are the procedures that pertain to intercomparison testing.

5.1 Test Setup

Follow the steps in Table 1 to set up the equipment.

Table 1 – Equipment setup

Step	Action
1	Ensure that auxiliary power is being provided to both the basic reference standard and transport standard.
	Note: The basic reference standard should not be disconnected or turned off unless deemed necessary.
2	A. Connect the BNC cable from channel 1 of the RS-703A data collection module to the output of the basic reference standard. B. Connect the BNC cable from channel 2 of the RS-703A data collection module to the output of the transport standard.
3	Connect the current leads in series from the current amplifier of the RS-703A to the basic reference and transport standards.
4	Connect the potential leads from the voltage amplifier of the RS-703A to the potential input of the basic reference standard. Jumper from the potential input of the basic reference standard to the transport standard.
	Note: Ensure polarity is correct. It is important to stay consistent with the polarity or the test results will be incorrect.
5	Select 'Watthour' display on both the basic reference standard and the transport standard.

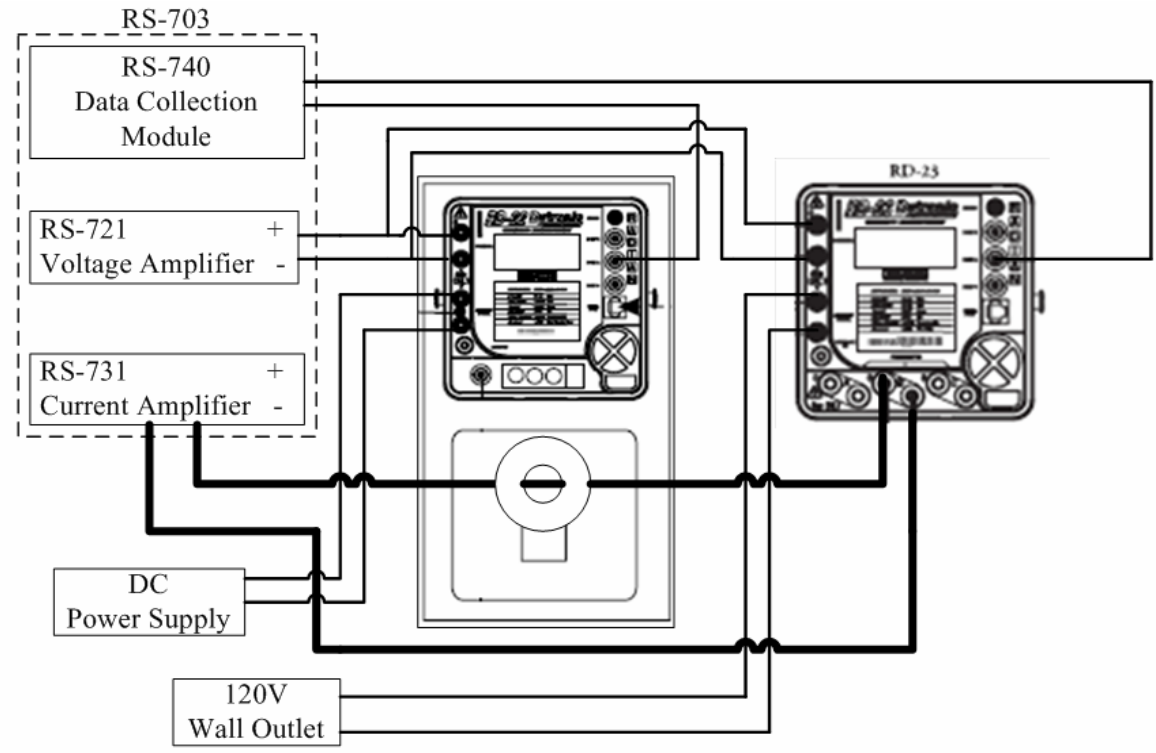


Figure 1 –Equipment setup for quarterly intercomparison

CAUTION

High voltage (up to 480V) is present at the terminals of the watthour standards.

5.2 Test Setup

Follow the steps in Table 2 to setup the software for an intercomparison test.

Table 2 – Selecting devices

Step	Action
1	Turn on the RS-703A system power supply with the appropriate key.
	Note: Energize the RS-703A for at least 30 minutes as suggested by Radian Research, Inc.
2	A. Turn the computer on. B. Double click on the 'RS-703A Control Program' icon located on the desktop.
3	A. On the 'Channel Table' screen, appropriately select the channel such that the devices under test are matched with their respective channels. B. Enter serial number of the devices under test accordingly.
	Note: For example, channel 1 and channel 2 should always be used for the basic reference standard and transport standard, respectively.
4	Make sure that the basic reference standard is used as the master reference standard. Do so, by making sure 'R1' on the 'Channel Table' screen is set to 'Reference' and check the boxes based on the channels of the devices under test. Leave 'R2' and 'R3' as 'None'.

5.3 Performing the Test

Follow the steps in Table 3 to perform an intercomparison test.

Table 3 – Performing the test

Step	Action
1	Click on 'Open a Test' icon and select 'Whr - MOPP Cert. Points'.
	Note: A screen will pop up with the test sheet. Leave everything as is. There should not be any changes made to the test sheet.
2	On the test sheet, click on 'Run'. This will begin the test.
3	Upon completion of the test, verify that the percent error values for the basic reference and transport standards are within its worst case accuracy.
	Note: Basic reference standard worst case accuracy: ± 0.01% Transport standard worst case accuracy: ± 0.01%
4	Print two copies of the test results. File one of the copies in the file cabinet in the laboratory and place the other copy in the black tray for the meter engineer.

6 Records Retention

PacifiCorp shall maintain a record of all the watthour standards including certification dates, results, and the person performing the certification. These records shall be maintained for a minimum of seven (7) years as required by PacifiCorp's Record Management department. However, it is at the discretion of the Metering Assets and

Technology department to decide whether to retain the aforementioned records after seven (7) years. Any electronic records/results shall be kept indefinitely i.e. as long as there is memory to store these records.

Quarterly Certification of the Field Transfer Standard

1 Scope

This document covers the procedure for quarterly certification of the field transfer standard against the basic reference standard using the Radian RS-703A Automated Calibration System.

2 Definition

The following abbreviation pertains to this document:

Basic Reference Standard: PacifiCorp's master reference standard. PacifiCorp currently uses Radian Research, Inc.'s RD-22
Meter Administrator Standard: A portable watthour standard that is certified quarterly with the basic reference standard
NIST: National Institute of Standards and Technology
NIST Traceable Independent Laboratory: An independent standards laboratory that is able to provide documental traceability to NIST
RS-703A System: Radian RS-703A Automated Calibration System

3 Introduction

PacifiCorp shall conduct quarterly certification of its field transfer standards. The standard shall be tested against the basic reference standard. By conducting a quarterly certification will help to determine the stability of the aforementioned reference standards. If one or both of the reference standards are found to be drifting out of calibration, appropriate action shall be taken. Typically this requires returning the drifting standard(s) to the manufacturer for inspection. Conducting a quarterly test is part of PacifiCorp's NIST traceability path.

4 Tools, Materials, and Equipment

The following tools, materials, and equipment are used to perform the quarterly certification tests:

- Basic reference standard (RD-22)
- Field transfer standard (RD-21)
- BNC cables
- Radian Research, Inc. potential and current cables
- Auxiliary power cables for Radian Research, Inc. reference standards

5 Procedures

Sections 5.1 to 5.3 are the procedures that pertain to intercomparison testing.

5.1 Test Setup

Follow the steps in Table 1 to set up the equipment.

Table 1 – Equipment setup

Step	Action
1	Ensure that auxiliary power is being provided to both the basic reference standard and field transfer standard.
	Note: The basic reference standard should not be disconnected or turned off unless deemed necessary.
2	A. Connect the BNC cable from channel 1 of the RS-703A data collection module to the output of the basic reference standard. B. Connect the BNC cable from channel 3 of the RS-703A data collection module to the output of the meter administrator standard.
3	Connect the current leads in series form the current amplifier of the RS-703A to the basic reference and transport standards.
4	Connect the potential leads from the voltage amplifier of the RS-703A to the potential input of the basic reference standard. Jumper from the potential input of the basic reference standard to the transport standard.
	Note: Ensure polarity is correct. It is important to stay consistent with the polarity or the test results will be incorrect.
5	Select 'Watthour' display on both the basic reference standard and the meter administrator standard.

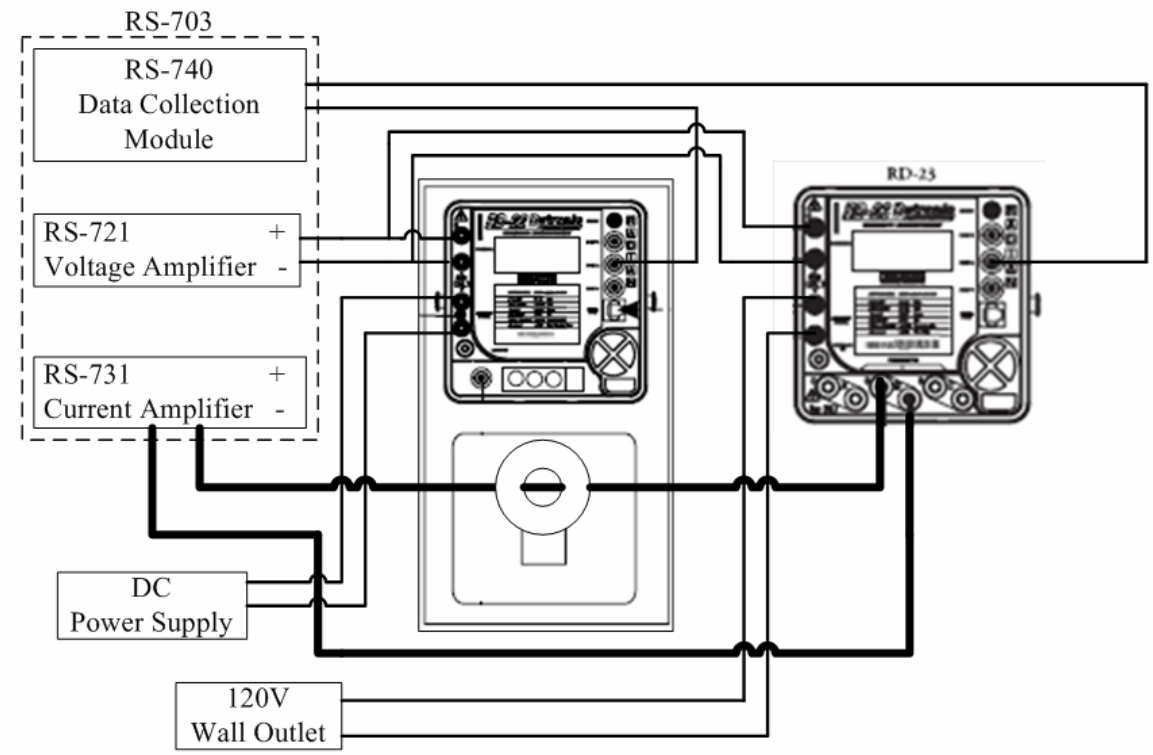


Figure 1 –Equipment setup for quarterly certification

CAUTION

High voltage (up to 480V) is present at the terminals of the watthour standards.

5.2 Test Setup

Follow the steps in Table 2 to setup the software for an intercomparison test.

Table 2 – Selecting devices

Step	Action
1	Turn on the RS-703A system power supply with the appropriate key.
	Note: Energize the RS-703A for at least 30 minutes as suggested by Radian Research, Inc.
2	A. Turn the computer on. B. Double click on the 'RS-703A Control Program' icon located on the desktop.
3	A. On the 'Channel Table' screen, appropriately select the channel such that the devices under test are matched with their respective channels. B. Enter serial number of the devices under test accordingly.
	Note: For example, channel 1 and channel 2 should always be used for the basic reference standard and transport standard, respectively.
4	Make sure that the basic reference standard is used as the master reference standard. Do so, by making sure 'R1' on the 'Channel Table' screen is set to 'Reference' and check the boxes based on the channels of the devices under test. Leave 'R2' and 'R3' as 'None'.

5.3 Performing the Test

Follow the steps in Table 3 to perform an intercomparison test.

Table 3 – Performing the test

Step	Action
1	Click on 'Open a Test' icon and select 'Whr - MOPP Cert. Points'.
	Note: A screen will pop up with the test sheet. Leave everything as is. There should not be any changes made to the test sheet.
2	On the test sheet, click on 'Run'. This will begin the test.
3	Upon completion of the test, verify that the percent error values for the basic reference and transport standards are within its worst case accuracy.
	Note: Basic reference standard worst case accuracy: ± 0.01% Meter administrator standard worst case accuracy: ± 0.02%
4	Print two copies of the test results. File one of the copies in the file cabinet in the laboratory and place the other copy in the black tray for the meter engineer.

6 Records Retention

PacifiCorp shall maintain a record of all the watthour standards including certification dates, results, and the person performing the certification. These records shall be maintained for a minimum of seven (7) years as required by PacifiCorp's Record Management department. However, it is at the discretion of the Metering Assets and Technology department to decide whether to retain the aforementioned records after seven (7) years. Any electronic records/results shall be kept indefinitely i.e. as long as there is memory to store these records.

PacifiCorp's Watthour Standard Procedure

1 Scope

This document covers the process of providing traceability of PacifiCorp's primary watthour standard to the national watthour standard. PacifiCorp's primary watthour standard is its basic reference standard; the Radian Research, Inc. RD-22 reference standard.

2 Definitions and Abbreviations

The following definitions and abbreviations pertain to this document:

Accuracy: Typical closeness of a particular measurement result to the true value. This can be expressed as the largest allowable error such as a percentage or an absolute value
NIST: National Institute of Standards and Technology
NIST Traceable Independent Laboratory: An independent standards laboratory that is able to provide documental traceability to NIST
PPM: Parts-per-million is equal to one millionth or 0.0001%
Random errors: Random errors are the drifts in the system during a test that are unaccountable, or are accountable but left uncorrected, for whatever reason (i.e., random fluctuations)
Resolution: The degree that small changes in a measure can be identified
Systematic errors: Systematic errors are a result of unique system problems where the tests are performed. If the errors are known, they can usually be corrected
Uncertainty: A range of values that reflect the degree of confidence to which a measured quantity is to the absolute value. This, in general, reflects an instrument's absolute accuracy. The wider the range of values, the lower the confidence you have in the particular measurement

3 References

J. D. Ramboz, et.al., *A Calibration Service for Wattmeters and Watthour Meters*, NBS. Technical Note 1179, U.S. Government Printing Office, Washington, D.C., July 1983.

N.Michael Oldham, *A Measurement Assurance Program for Electric Energy*, NBS. Technical Note 930, U.S. Government Printing Office, Washington, D.C., 1976.

ANSI C12.1 *Code for Electricity Metering*

MOPP 3.1 *Watthour Reference Standard*

4 General

The master watthour standard is used to certify all other standards including:

- Transport standard (RD-23)
- Field transfer standards (RD-21s)
- Shop meter test boards standards
- Field standards in automatic test sets
- Field standards used with load boxes

5 Introduction

PacifiCorp's watthour reference standards are all traceable to the national watthour standard maintained by NIST.

Every year, PacifiCorp certifies its primary reference standard with a NIST traceable standard.

Figure 1 shows the traceability path from NIST to PacifiCorp's reference standards. PacifiCorp's sequential chain of traceability begins at a NIST traceable independent laboratory; in particular, Radian Research, Inc.

6 PacifiCorp's Reference Standards

6.1 Basic Reference Standard

The Radian Research RD-22 is a precision solid-state reference standard used by PacifiCorp as its basic reference standard. This standard is certified to the national standard annually. The basic reference standard test results are documented on the RS-703A system quarterly. Quarterly intercompare between the basic reference standard and the transport standard provides additional data associated with stability. The basic reference standard is certified to the national standard maintained by NIST using the test points shown in Table 1. All phase angles in Table 1 are lagging phase angles.

Table 1 – Basic reference standard certification points

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

6.2 Transport Standard

The Radian Research Inc., RD-23 is a precision solid state reference standard used as an engineering transport standard. This standard does not leave the facility except to be transported back to Radian Research, Inc. for annual certification and calibration (if necessary). Test points used to certify the transport standard, are shown in Table 2. The transport standard provides the traceability from PacifiCorp's reference standards to NIST. The transport standard is intercompared with the basic reference standard quarterly using the test points shown in Table 2. All phase angles in Table 2 are lagging phase angles.

Table 2 – Transport reference standard certification points

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

6.3 Field Transfer Standard

The Radian Research, Inc. RD-21 is a solid state reference standard used to certify field watthour standards annually. Field transfer standards are certified quarterly against the basic reference standard using the test points shown in Table 3. All phase angles in Table 3 are lagging phase angles.

Table 3 – Field transfer standard certification points

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

6.4 Field Standard

The Radian Research, Inc. RD-20 and RM-10 are solid state reference standards found either mounted within field automatic test boards or with portable load boxes. Portable standards are certified annually against the field transfer standard using the test points shown in Table 4. All phase angles in Table 4 are lagging phase angles.

Table 4 – Field standard certification points

	Voltage & Phase Angle							
	120		240		277		480	
Amps	0°	60°	0°	60°	0°	60°	0°	60°
0.25								
0.5								
1.5								
2.5								
3								
5								
15								
30								
50								

6.5 Automated Calibration System

The Radian 703A system is a computer-operated calibration system that has the ability to test several solid state standards simultaneously, but only seven channels are available of its sixteen channels. This system provides an automated method to document the master standard certification, transport standard calibration, and transport standard certification. The 703A system is certified monthly to the Company's basic reference standard.

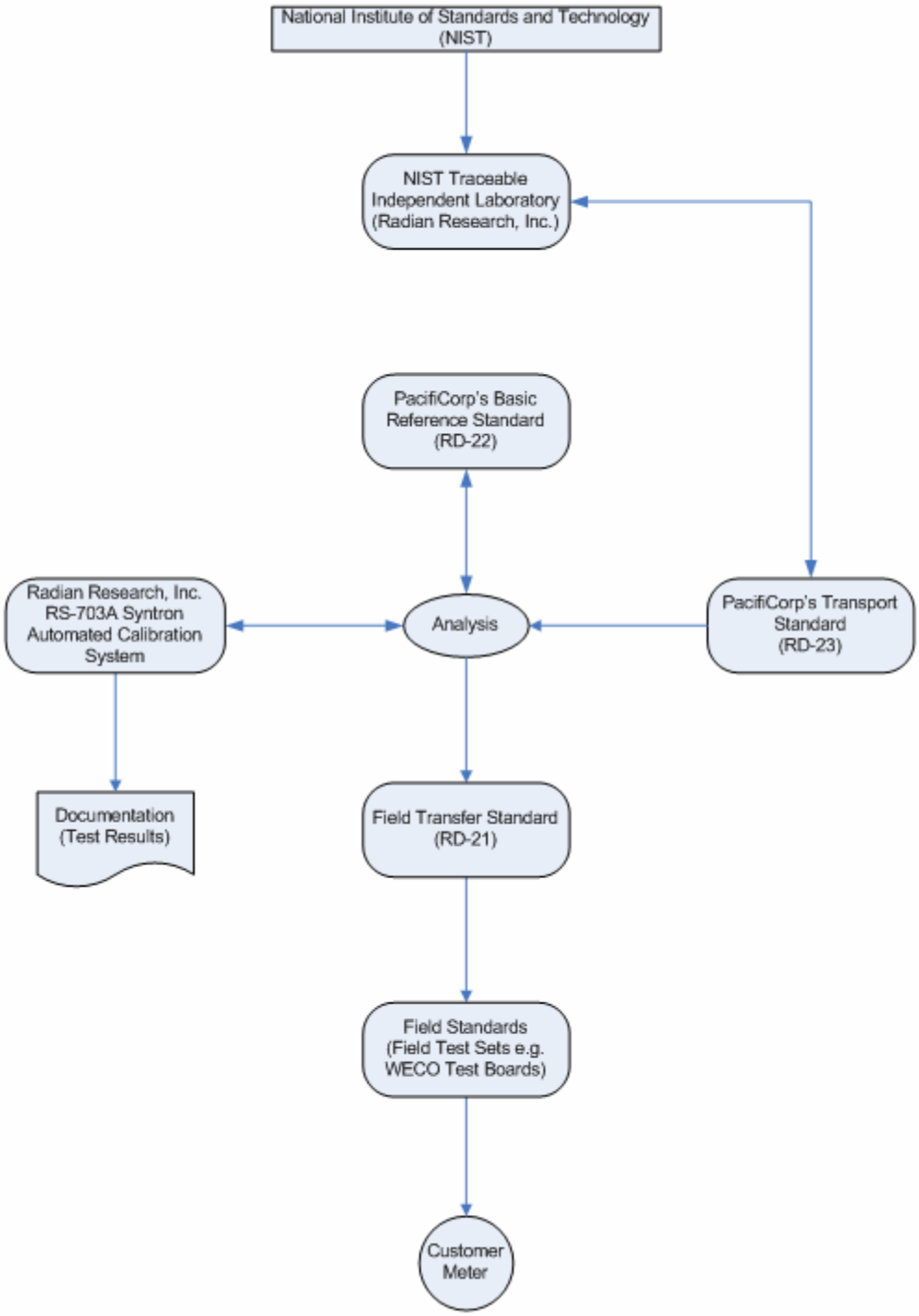


Figure 1 – PacifiCorp's traceability diagram

7 NIST Certification Process

7.1 Meter Engineer's Responsibility

The meter engineer shall monitor trends of the quarterly and annual certifications and recommend corrective action as needed. The meter engineer shall also ensure NIST traceability of PacifiCorp's reference standards.

Table 5 describes the process of annual NIST certification.

Table 5 – NIST certification process

Step	Description
1	The NIST traceable independent laboratory certifies its basic reference standards to the national watthour standard maintained by NIST to an uncertainty of 0.003% (30 PPM).
2	The NIST traceable independent laboratory certifies PacifiCorp's transport standard against its basic reference standards to an uncertainty of 0.003% (30 PPM) annually.
3	The NIST traceable independent laboratory returns PacifiCorp's transport standard to PacifiCorp.
4	Upon return of the transport standard, the transport standard is verified against PacifiCorp's basic reference standard to an accuracy of 0.01% (100 PPM) using the test points shown in Table 6 and utilizing the RS-703A system.
5	At the completion of the test, PacifiCorp compares its results with the results from the NIST traceable independent laboratory. In doing so an accuracy crosscheck is completed and establishes traceability to the national watthour standard maintained by NIST.
6	The field transfer standards are certified quarterly to an accuracy of 0.02% (200 PPM) using the test points shown in Table 6 and utilizing the RS-703A system.
7	The field transfer standards are used to certify field standards found in automated test boards e.g. WECO test boards, to an accuracy of 0.04% (400 PPM) or 0.05% (500 PPM) depending on the reference standard found in these test boards.
8	Metermen test the accuracy of the customer's meter using their automated test boards and can be assured that the customer's meter is accurate to 0.1% (1000 PPM) or better.

Table 6 – Certification test points (All phase angles are lagging phase angles)

	Voltage & Phase Angle											
	120						240		277		480	
Amps	0°	60°	120°	180°	240°	300°	0°	60°	0°	60°	0°	60°
0.25												
2.5												
5												
5												
5												
15												
30												
30												
30												
50												

8 Records Retention

PacifiCorp shall maintain a record of all the watthour standards including certification dates, results, and the person performing the certification. These records shall be maintained for a minimum of seven (7) years as required by PacifiCorp's Record Management department. However, it is at the discretion of the Metering Assets and Technology department to decide whether to retain the aforementioned records after seven (7) years. Any electronic records/results shall be kept indefinitely i.e. as long as there is memory to store these records.

8.1 Basic Reference Standard

Two copies of the test results from the basic reference standard certification shall be retained. One copy of the test results shall be filed in the designated filing cabinet located near the RS-703 system. The second copy shall be for the meter engineer of whom shall track the stability of the reference standard and advise appropriate action should the basic reference standard drift out of calibration.

8.2 Transport Standard

Two copies of the test results from the annual transport standard verification shall be retained. One copy of the test results shall be filed in the designated filing cabinet located near the RS-703 system. The second copy shall be for the meter engineer of whom shall track the stability of the reference standard and advise appropriate action should the transport standard drift out of calibration. Annual certification of the transport standard shall be done by Radian Research, Inc. where upon return of the transport standard a report of the test results will be provided. This report shall be maintained by the meter engineer.

8.3 Field Transfer Standards

Two copies of the test results from the quarterly certification of the field transfer standard shall be retained. One copy of the test results shall be filed in the designated

filing cabinet located near the RS-703 system. The second copy shall be for the meter engineer of whom shall track the stability of the reference standard and advise appropriate action should the basic reference standard drift out of calibration.

8.4 Field Standards

Test records of the certification of field standards shall be sent to the meter administrator based on service territory location. Those states serviced by Pacific Power will send an electronic copy of their test records to Pacific Power's designated meter administrator. Those states serviced by Rocky Mountain Power will send an electronic copy of their test records to Rocky Mountain Power's designated meter administrator. A specific format shall be used when saving the test results upon completion of a field standard certification shown in Figure 2.

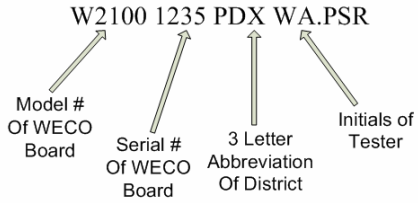


Figure 2 – WECO certification test result file name format

It is the responsibility of the meter administrator to save all electronic test records sent via e-mail to the J: drive located in this directory:

J:\Groups\Metering\Administrators - Field Support\Administrators\Reports-Weco+ Weco Certifications

In this directory, the meter administrator shall place the test results in the appropriate folder based on the year tested, the service territory i.e. Pacific Power or Rocky Mountain Power and district e.g. Portland.

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Policy

METER MAINTENANCE AND TESTING POLICY

Metering Standards and Engineering Policy No. 052

(PolicyTech Version 3)

Author:	June Sabbah
Approval:	Douglas Marx
Authoring Department:	Metering Standards and Engineering
Approved File Location:	PacifiCorp.us\DFS\PDXCO\SHR04\ENG\Publications\FPP\RLY\
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Revision Number:	R5 *(PolicyTech Version 3)*
Revision Date:	11/24/2021

Document Security Category			
	Confidential	X	External
	Restricted		Critical Infrastructure Information (CII)
X	Internal		

Revision Log		
0	1/15/03	Initial issue.
1	7/13/07	General revisions.
2	1/3/17	Complete revision.
3	2/16/17	This revision includes title page updates,"Table C" has new form numbers, and the bidirectional flag for nonretail meters has been updated. PolicyTech versioning has been added to allow cross publication on the metering and PolicyTech pages.
4	11/18/20	Information cleanup, removal of a table that is part of Policy 001 and removal of section 3.3 New Residential Meter Test Program.
5	11/24/21	Policy ownership and Table 3 have been updated.

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Policy

METER MAINTENANCE AND TESTING POLICY
Table of Contents

METER MAINTENANCE AND TESTING POLICY
Metering Standards and Engineering Policy No. 052

1 Scope

This document defines the accuracy limits, testing requirements, and retirement criteria for PacifiCorp-owned new and used meters.

2 General Meter Testing Definitions and Equipment

2.1 General Requirements

The following lists summarize PacifiCorp's standard meter testing requirements for new and used meters. These requirements are the minimum and do not cover any other procedural testing deemed necessary by local management.

- New Meters

  The testing requirements for new meters shall include the following:

Certified test data:	Manufacturers shall provide certified test data for all new meters purchased by PacifiCorp.
Instrument-rated meters:	All new instrument-rated meters shall be tested by PacifiCorp before or within the 90-day installation check-back period.

- Used Meters

  The testing requirements for used meters shall include the following:

In-service meters:	All in-service meters that were scheduled to be tested as part of the annual metering test program shall be tested.
Obsolete meters:	Obsolete meters that are on the annual meter test program shall be tested before removal from service for retirement. All other obsolete meters shall not be tested before retirement.
Return-to-service meters:	A meter that has been removed from one service address shall be tested before it is installed at another service address. Meters that are re-assigned from one account to another account at the same service address need not be tested.

2.2 Testing Equipment

2.2.1 Reference Standard

A Watt-hour/VAR-hour standard that is certified annually and is traceable to the National Institute of Standards and Technology (NIST) is required.

Standards in use by PacifiCorp include the following:

- WECO 3000/3010 PAT Unit (with integrated power supply)
- WECO 2150/2350 Test Board (with integrated power supply)
- Radian RD-21 and RD-23

2.2.2 External Power Supply

Configurable voltage (0 – 480 VAC), current (0 – 20 amps), and power factor (0 – 359° test angle) power supply.

Power supplies in use by PacifiCorp include the following:

- Doble F6150

2.2.3 Current, Voltage, and Phase-Angle Meters

Circuit analyzers capable of voltage, current, and phase-angle measurements

Circuit analyzers in use by PacifiCorp include the following:

- Powermetrix PowerMate 330/330A, Powermetrix PowerMaster 7300 Series, Testmet Goldminer

2.2.4 CT Burden Tester

A device capable of injecting burden into the CT secondary and recording any change in CT accuracy while the CT is in-service.

CT burden testers in use by PacifiCorp include the following:

- Powermetrix PowerMate 330/330A, Powermetrix PowerMaster 7300 Series, testMET Goldminer

2.2.5 Laptop with Meter Vendor Software

A standard company-issued laptop must be loaded with all necessary software for running the above test equipment. In addition, appropriate vendor software for reading and configuring the meters must be available.

2.3 Meter Test Requirements

The following sections describe the standard meter tests used to measure meter accuracy. The tests which apply to a specific meter type and which should be performed when measuring its accuracy along with the number of disc revolutions or test pulses that should be used for each test are given in Section 4 of this document.

2.3.1 Series Full Load

The series full load meter test measures the percent registration of the meter at nameplate voltage and test amps applied simultaneously to all elements and with current and voltage in phase. This meter test is designated by %FL.

2.3.2 Series Light Load

The series light load meter test measures the percent registration of the meter at nameplate voltage and 10% of nameplate test amps applied simultaneously to all elements and with current and voltage in phase. This meter test is designated by %LL.

2.3.3 Series Power Factor

The series power factor meter test measures the percent registration of the meter at nameplate voltage and test amps applied simultaneously to all elements and

with current lagging voltage by 60 degrees. This meter test is designated by %PF.

2.3.4 Series Customer Load Test

Customer load is only to be used if absolutely necessary.

2.3.5 Single-Element Full Load

The single-element, full load meter test measures the percent registration of the meter at nameplate voltage and test amps applied only to an individual element and with current and voltage in phase. This meter test is designated by %A-FL, %B-FL, or %C-FL corresponding to the element that is tested.

2.3.6 Bidirectional

For all net metering applications, watt-hours delivered and watt-hours received shall be tested.

2.3.7 Four Quadrant

The four quadrants of power flow are watt-hours delivered, VAR-hours delivered, watt-hours received, and VAR-hours received. If a retail load does not have bidirectional power flow then only a two-quadrant test of watt-hours delivered and VAR-hours delivered will be performed. The four standard tests are performed with a phase angle shift between the current and voltage as shown below in Table 1. Note that positive values indicate that current lags voltage by the indicated angle.

Table 1 – Phase Angles for Four Quadrant Standard Tests

	FL Phase Angle	LL Phase Angle	PF Phase Angle	Element Phase Angle
Watt-Hours Delivered	0°	0°	60°	0°
VAR-Hours Delivered	90°	90°	150°	90°
Watt-Hours Received	180°	180°	240°	180°
VAR-Hours Received	270°	270°	330°	270°

2.3.8 KYZ Output Pulses

This test is only required when the meter is providing KYZ output pulses to PacifiCorp SCADA. If pulses are provided to a customer, these will only be tested by special request.

2.3.9 mA Analog Outputs

This test is only required when a meter is providing mA analog outputs to PacifiCorp SCADA. Verify the value from the meter to the end device at 90% full load, 0% full load, and -90% full-load.

2.3.10 Loss Compensation

At a minimum, the meter shall be tested:

- Without loss compensation in accordance with Section 4, and
- With loss compensation at the full load and light load testing points

2.4 Meter Cover Removal

All in-service meter tests should be performed without removing the meter cover unless the test cannot be performed without removing the cover — for example, if the photo pick-up is unable to read the disk of an electromechanical meter accurately because of a dirty cover, or if the cover must be removed to place a solid-state meter in test mode.

2.5 Number of Runs

Only one complete test run is required for each meter test. For adjustable meters, if the meter requires calibration, additional tests or runs will be performed after any adjustments are made to verify that the results were satisfactory.

2.6 Photo Pick-Up

Standard procedure for meter testing includes using the photo pick-up to count disk revolutions or test pulses of the meter. The photo pick-up automates the test, is more accurate than manual methods, and establishes higher customer confidence in the tests.

2.7 Leveling the Test Board

Before performing any accuracy tests on electromechanical or hybrid meters, ensure that the test board is as level as possible. This is especially important to remember when using a test board that is mounted in a company vehicle as any inclination can strongly influence the results of the tests. This is especially true of the results of light load tests.

3 Test Programs

3.1 Annual In-Service Meter Test Program

3.1.1 Purpose

The annual in-service meter performance test program provides meter performance data for a year-end statistical analysis to ensure that metering accuracy standards are being maintained throughout the service life of meters. The annual in-service test program is for all PacifiCorp owned revenue watt-hour meters in order to meet company requirements and to conform to the state regulatory agencies' approved use of the American National Standards Institute (ANSI) standard C12.1 guidelines.

3.1.2 Test Program

The annual in-service test program is divided into two categories: statistical sampling tests, and periodic interval tests. Meters are assigned to one of the two testing categories based on the billing multiplier as provided by the company's Customer Service System (CSS).

- **All in-service meters with a meter multiplier of 40 or less fall into the statistical sampling test category.**
- **All in-service meters with meter multiplier greater than 40 fall into the periodic interval test category.**

3.1.3 Scheduling

The meters to be tested for the annual tests shall be selected and scheduled for testing in January each year. All metering test data for the previous year shall be entered before December 1st.

3.1.4 Periodic Interval Tests

Periodic testing provides a fixed interval of two, eight and sixteen years between tests. To select meters for periodic testing, Table 2 — Interval Schedule for Testing shall be used:

Table 2 — Interval Schedule for Testing

Meter Multiplier	Test Interval
>= 600	2 years
>=80 and <600	8 years
>40	16 years

3.2 Non-Retail Meter Test Program

3.2.1 Purpose

The Non-Retail Meter Test Program is in place to ensure the accuracy limits and testing procedures for non-retail meter applications, such as: balancing area authority changes (interties), generation metering, borderlines (transmission customers), jurisdictional loads (state boundaries) and check meters. At some of these installations, the meter test may involve additional entities. At sites where another entity owns the meter, the entity's test policy will be followed, provided it is comparable to PacifiCorp's. If a special agreement has been signed by all affected entities, then that agreement will supersede this policy.

3.2.2 Requirements

Testing will meet all NERC, ANSII, and WREGIS standards as well as all contractual agreements with other entities. Details of test frequency by meter installation type are defined in Policy 001. Intertie meters with output signals to SCADA will require NERC BAL-005 common source verification of AGC signal. Generation meters may require scheduling coordination between groups to ensure meters are tested during planned shutdowns so that the maintenance plan timeframe is met.

3.2.3 Exceptions

If a meter test cannot be completed during the normal test cycle for a valid reason, that reason must be documented in writing and provided to asset management, the operations manager, and any affected foreign entities. Valid reasons include but are not limited to: safety concerns, access restrictions, contractual agreements, and plant outage restrictions. All exceptions must be approved by the local operations manager and asset management.

3.3 Major Project Meter Test Program

3.3.1 Purpose

The major project meter test program provides quality assurance verification for all new meters received by the company for major projects. Each lot of meters will be sample tested and inspected before they are approved by the company for installation. The sample sizes, as show in Table 3, depends on the meters lot size.

Table 3 — Sample Size

Meter Type	Meter Lot Size	Sample Size
Group 1 All single-phase, self-contained, form 2S, class 200, 240 volts, kWh only	Less than 2400	4%
	2400 to 5760	One pallet
	5761 to 11520	Two pallets
Group 2 All other types of single-phase and three-phase meters.	Less than 2400	10%
	2400 to 5760	One pallet

If more than 2.0% of the meters test outside the accuracy limits or fail physical inspection, another sample of meters will be selected. If more than 2.0% of the new sample meters fail the lot of meters will be returned to the factory.

3.3.2 Validation Results

The results of the tests will be analyzed by metering standards for conformance with stated accuracy and specifications.

Metering standards will report to the meter manufacturer any problems discovered with the new meter quality or accuracy and will work with the manufacturer to correct any deficiencies.

4 Meter Accuracy Limits and Test Requirements

4.1 Meter Testing Requirements

Table 4 shows the meter testing requirements.

4.2 Meter Accuracy Limits

Table 5 shows the meter accuracy limits.

Table 4 — Meter Testing Requirements

		Meter Testing Requirements																
		Watts						VARs										
		%FL	%LL	%PF	%A-FL	%B-FL	%C-FL	%FL	%LL	%PF	%A-FL	%B-FL	%C-FL	Bidirectional	4-Quad	KYZ	mA Analog Outputs	Loss Compensation
Retail	Single-Phase, Electro-Mechanical and Hybrid	x	x	na	na	na	na	na	na	na	na	na	na	na	na	na	na	if applicable
	Single-Phase, Solid-State	x	x	na	na	na	na	na	na	na	na	na	na	na	na	na	na	if applicable
	Three-Phase, Solid-State, Self-Contained	x	x	x	na	na	na	na	na	na	na	na	na	na	na	na	na	if applicable
	Three-Phase, Solid-State, Instrument-Rated	x	x	x	x	x	x	na	na	na	na	na	na	na	na	na	na	if applicable
	Three-Phase, Electro-Mechanical and Hybrid	x	x	x	x	x	x	na	na	na	na	na	na	na	na	na	na	if applicable
	Single-Phase, Electro-Mechanical and Hybrid, Net	x	x	na	na	na	na	na	na	na	na	na	na	x	na	na	na	if applicable
	Single-Phase, Solid-State, Net	x	x	na	na	na	na	na	na	na	na	na	na	x	na	na	na	if applicable
	Three-Phase, Solid-State, Self-Contained, Net	x	x	x	na	na	na	na	na	na	na	na	na	x	na	na	na	if applicable
	Three-Phase, Solid-State, Instrument-Rated, Net	x	x	x	x	x	x	na	na	na	na	na	na	x	na	na	na	if applicable
	Three-Phase, Electro-Mechanical and Hybrid, Net	x	x	x	x	x	x	na	na	na	na	na	na	x	na	na	na	if applicable
Non-Retail	3rd Party Borderload	x	x	x	x	x	x	x	x	x	x	x	x	x	x	if applicable	if applicable	if applicable
	Interchange	x	x	x	x	x	x	x	x	x	x	x	x	x	x	if applicable	if applicable	if applicable
	Generation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	if applicable	if applicable	if applicable
	Check or Jurisdictional Load	x	x	x	x	x	x	x	x	x	x	x	x	x	x	if applicable	if applicable	if applicable
	Check Meter	x	x	x	x	x	x	x	x	x	x	x	x	x	x	if applicable	if applicable	if applicable

Table 5 — Meter Accuracy Limits

	Metering Accuracy Limits														
	Watts						VARs								
	%FL	%LL	%PF	%A-FL	%B-FL	%C-FL	%FL	%LL	%PF	%A-FL	%B-FL	%C-FL	KYZ	mA Analog	Actions
Single-Phase, Electro-Mechanical and Hybrid	± 1%	± 1%	na	na	na	na	na	na	na	na	na	na	na	na	Do not adjust. If accuracy falls outside of limit, remove from service.
Single-Phase, Solid-State	± 0.5%	± 1%	na	na	na	na	na	na	na	na	na	na	na	na	
Three-Phase, Solid-State, Self-Contained	± 0.5%	± 1%	± 1%	na	na	na	na	na	na	na	na	na	na	na	
Three-Phase, Solid-State, Instrument-Rated	± 0.5%	± 1%	± 1%	± 1%	± 1%	± 1%	na	na	na	na	na	na	na	na	
Three-Phase, Electro-Mechanical and Hybrid, Self-Contained	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	na	na	na	na	na	na	na	na	
Single-Phase, Solid-State (**Washington only**)	± 0.5%	± 0.5%	na	na	na	na	na	na	na	na	na	na	na	na	
Three-Phase, Solid-State, All Meters (**Washington only**)	± 0.5%	± 0.5%	± 0.5%	± 0.5%	± 0.5%	± 0.5%	na	na	na	na	na	na	na	na	
High-End Solid-State Meters (ION, Elite, 2510, etc)	± 0.2%	± 0.2%	± 0.3%	± 0.2%	± 0.2%	± 0.2%	± 0.2%	± 0.2%	± 0.3%	± 0.2%	± 0.2%	± 0.2%	± 0.3%	± 2%	*

* These meters cannot be calibrated. Any meter that tests outside the limits must be removed from service.

4.3 Other Accuracy Requirements

4.3.1 Major Projects Accuracy Limits

Shown in Table 6 are the accuracy specifications for each meter type/group for major projects.

Table 6 — Accuracy Specifications by Meter Type

Type	Accuracy Standard	Allowable Percent Error by Test Type	
		%Full Load	All Other Tests
All single-phase and network meters	ANSI 12.20, 0.5% accuracy class	± 0.5%	± 0.7%
All three-phase meters	ANSI 12.20, 0.2% accuracy class	± 0.2%	± 0.4%

5 Retirement Requirements for In-Service Meters

The purpose of this section is to prescribe meter removal and retirement criteria for meters being used or to be used for the revenue metering of electric energy and to outline procedures that will reasonably assure compliance with the requirements of this section.

5.1 General Requirements

No meter shall be placed in service, or be allowed to remain in service, that:

- Has an incorrect register constant, watthour constant, gear ratio, or dial train
- Is mechanically, electrically, electronically, or otherwise defective
- Is incorrectly connected, installed, or applied
- Tests outside the accuracy limits in the applicable subsection of this document
- Is on the meter retirement list
- Is a potential safety hazard
- Meters with jewel bearings
- Mechanical demand meters
- Thermal demand meters
- A-base meters which have been removed from service
- Meters with any manufacturing or design defect which causes inaccuracy in a significant percentage of the meter type
- Any meter type which no longer has software support
- Any meter with an “OBS” MERC (Meter Equipment Retirement Code)
- Any three-phase, electro-mechanical and hybrid, instrument-rated meters

Meters meeting the criteria for removal from service shall be identified during normal field visits. This document does not authorize field visits for the specific purpose of identifying meters that meet the removal criteria; metermen shall not make field visits specifically for this purpose.

If a meter is on the annual test schedule and meets any of the removal criteria above, an as-found test shall be performed, and then the meter shall be removed from service. All other meters that meet any of the non-accuracy-related criteria above shall be removed from service without performing an as-found test. If any meter which is still under warranty is removed from service, it shall be returned directly to the manufacturer or to the Meter Test Facility (MTF).

Whenever a meter is retired, it is important to reference a valid retirement code for entry into CSS.

5.1.1 Retirement Constraints

All failed meter group retirements are subject to the following constraints:

- The retirements of meters are to be under a company-approved plan. The plan will include a budgeting requirement estimate and implementation program. The meters are to be retired as scheduled in the company-approved implementation program.
- All meters that meet the retirement criteria and are under warranty shall be returned to the manufacturer.

5.1.2 Scheduled Test

If a meter is to be tested as part of the scheduled statistical sampling test program and the meter is on the company meter retirement list, it shall be tested first then retired.

5.1.3 Customer-Requested Meter Test

If a meter is to be tested as a result of a customer request for meter test, and the meter is on the company meter retirement list, it shall be tested first.

5.1.4 Meter Site Visit

If a meter site is being visited for any reason other than for a scheduled test or customer requested test, and the meter is on the company meter retirement list, it shall be removed from service and retired without testing.

Remove from service any meter that may be a potential hazard to personnel or equipment.

5.2 High- or Low-Bill Complaint Meters

All tests generated and requested by customer service for high- or low-bill complaints shall be performed, even if the meter is on the company meter retirement list.

The accuracy of a high- or low-bill complaint meter shall not be adjusted. If the error is within +/- 2% for both the full load and light load test, it shall remain in service even if the meter meets one or more of the removal criteria in this policy. Any high or low bill complaint meter whose error is greater than +/-2% for the full load or light load tests should be removed from service.

A high- or low-bill complaint meter may be removed immediately from service if it is a potential safety hazard.

In the event that a high bill complaint meter is immediately removed from service, the meter must be kept and tagged in the local shop until the customer service representative has resolved the situation with the customer or for one year.

5.3 AMR Designated Area Meters

Any non-AMR meter removed from its socket in an AMR designated area shall be replaced with an AMR meter.

5.3.1 Disconnect Services

Any non-AMR meter in an AMR designated area that is removed from its socket for disconnect purposes shall be reinstalled. The original meter is needed to keep track of the disconnected service. When the site is visited for reconnection, the meter shall be replaced with an AMR meter.

5.4 Meter Retirement List

Table 7 below summarizes the meter types that should be retired. Meters can be added to this retirement list one of two ways: First, a meter test group included in the Annual Meter Testing program tested per the ANSI standard C12.1 fails to meet the required passing rate two years in a row. Asset management conducts a yearly review of the previous years Annual Meter Testing program to determine any populations that do not meet ANSI C12.1; second,metering standards may be notified by metering of a mass failure of a meter population occuring during the year's annual tests — in which case, the meter group will be immediately added to the retirement list below.

Table 7 — Meters to Be Retired by Model and Register Type

Model	Register	Action	Notes
J3S	MECH KWH	Retire	
J5S	IMS-I200	Retire	Hexagram
P30	MECH KWH	Retire	
PW	MECH KWH	Retire	
All	DE-5	Retire	Mechanical Demand
All	ST-D101	Retire if reprogramming is required	
EV	ALL	Retire	Failed Sample Test
All	ST-MT100	Retire if reprogramming is required	
D5S	All	Retire	Failed Sample Test
All	EMF-2110	Retire if reprogramming is required	
All	EMF-2430	Retire if reprogramming is required	
All	MARK III	Retire	Mechanical Demand
MS	PDR	Retire if reprogramming is required	
MS	DDMS	Retire if reprogramming is required	
MT	PDR	Retire if reprogramming is required	
All	TM-91	Retire if reprogramming is required	
All	M-90	Retire if reprogramming is required	
V-2	MECH KWH	Retire	Jewel Bearing
V-3	MECH KWH	Retire	Jewel Bearing
V-4	MECH KWH	Retire	Jewel Bearing
V-6	MECH KWH	Retire	Jewel Bearing
V-9	MECH KWH	Retire	Jewel Bearing
All	M-30	Retire	Mechanical Demand
All	M-50	Retire	Mechanical Demand
All	M-60	Retire	Mechanical Demand
KV	ALL	Retire 21, 23 Million Series	Only 21, 23 Million