DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

PUBLIC SERVICE COMMISSION

TECHNICAL STANDARDS FOR ELECTRIC SERVICE

(By authority conferred on the public service commission by section 7 of 1909 PA 106, MCL 460.557, section 2 of 1909 PA 300, MCL 462.2, section 5 of 1919 PA 419, MCL 460.55, sections 4 and 6 of 1939 PA 3, MCL 460.4 and 460.6, and sections 3, 9, and 231 of the executive organization act of 1965, 1965 PA 380, MCL 16.103, 16.109, 16.331, and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4, and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

R 460.3102 Definitions.

Rule 102. As used in these rules:

(a) "Approved by the commission" means that a commission order has been issued.

(b) "Commission" means the Michigan public service commission.

(c) "Customer" means an account holder who purchases electric service from a utility. An individual who is a customer must be at least 18 years of age or an emancipated minor

(d) "Electric plant" means all real estate, fixtures, or property that is owned, controlled, operated, or managed in connection with, or to facilitate the production, transmission, and delivery of, electric energy.

(e) "Electricity meter" means a device that measures and registers the integral of an electrical quantity with respect to time.

(f) "Electro-mechanical meter" means a meter in which currents in fixed coils react with the currents induced in the conducting moving element, generally a disk or disks, which causes their movement proportional to the energy to be measured. This meter may also be called an induction watthour meter.

(g) "File" means to deliver to the commission's executive secretary.

(h) "Meter" or "watthour meter" means an electricity meter that measures and registers the integral with respect to time of the active power of the circuit in which it is connected. The unit by which this integral is measured is usually the kilowatt-hour.

(i) "Meter error" means a failure to accurately measure and record all of the electrical quantities used that are required by the applicable rate or rates.

(j) "Meter shop" means a shop where meters are inspected, repaired, and tested. A meter shop may be at a fixed location or may be mobile.

(k) "Premises" means an undivided piece of land that is not separated by public roads, streets, or alleys.

(l) "Solid state meter" means a meter in which current and voltage act on electronic (solid state) elements to produce an output proportional to the energy to be measured.

(m) "Submit" means to deliver to the commission's designated representative.

(n) "Utility" means a firm, corporation, cooperative, association, or other legal entity that is subject to the jurisdiction of the commission and that distributes, sells, or provides electric service.

Commented [A1]: DTEE - Electro-mechanical meter related requirements have been highlighted throughout the Technical Standard so that the MPSC can easily remove them when they become NA.

PART 3. METER REQUIREMENTS

R 460.3301 Metered measurement of electricity required; exceptions.

Rule 301. (1) All electricity that is sold by a utility shall be on the basis of meter measurement, except where the consumption can be readily computed or except as provided for in a utility's filed rates.

(2) Where practicable, the consumption of electricity within the utility or by administrative units associated with the utility shall be metered.

(3) Meters shall be in compliance with part 6 of these rules.

History: 1983 AACS; 1996 AACS.

R 460.3302 Rescinded.

History: 1983 AACS; 1996 AACS.

R 460.3303 Meter reading data.

Rule 303. The meter reading data must include all of the following information:

(a) A suitable designation identifying the customer.

(b) Identifying number and description of the meter.

(c) Meter readings or, if a reading was not taken, an indication that a reading was not taken.

(d) Any applicable multiplier or constant.

History: 1983 AACS; 1996 AACS; 2019 AACS.

R 460.3304 Meter data management ~~collection~~ system.

Rule 304. A meter data management ~~collection~~ system that takes data from recording meters must indicate all of the following meter information:

(a) The date of the record.

(b) The equipment numbers.

(c) A suitable designation identifying the customer.

(d) The appropriate multipliers.

History: 1983 AACS; 1996 AACS; 2019 AACS.

R 460.3305 Meter multiplier.

Rule 305. If it is necessary to apply a multiplier to the meter registration, then the multiplier shall be displayed on ~~the face of~~ the meter.

History: 1983 AACS; 1996 AACS.

Commented [A2]: DTEE - Aligned with industry terminology

R 460.3306 Rescinded.

History: 1983 AACS; 1996 AACS; 2008 AACS.

R 460.3307 Rescinded.

History: 1983 AACS; 1996 AACS.

R 460.3308 Standards of good practice; adoption by reference.

Rule 308. In the absence of specific rules of the commission, a utility shall apply the provisions of the publications set forth in this rule as standards of accepted good practice. The following standards are available from the American National Standards Institute (ANSI), Customer Service, 25 West 43rd St., 4th floor, New York, New York, 10036, USA, telephone number: 1-212-642-4900 or via the internet at website: http://webstore.ansi.org at the cost listed below as of the time of adoption of these rules, plus a handling charge (for paper copies):

(a) American National Standards Institute standards for electricity meters ANSI C12.1-2014, cost $279.00, ~~and~~C12.20-2015, cost ~~$107.00~~ 115.56, and C12.22-2012, cost $250.95.

(b) American National Standards Institute/American Society for Quality Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming (ANSI/ASQ Z1.9-2003(R201~~3~~8)). Cost $179.00.

(c) American National Standards Institute IEEE Standard Requirements for Instrument Transformers (ANSI C57.13-2016). Cost $119.00.

(d) American National Standards Institute IEEE Standard for High Accuracy Instrument Transformers, IEEE Std. C57.13.6-2005. Cost $50~~7~~.00.

History: 1996 AACS; 2008 AACS; 2019 MR 1, Eff. Jan. 9, 2019; 2019 MR 13, Eff. July 16, 2019.

R 460.3309 Metering inaccuracies; billing adjustments.

Rule 309. (1) An adjustment of bills for service for the period of inaccuracy must be made for over registration and may be made for under registration under any of the following conditions:

(a) ELECTRO-MECHANICAL: An electro-mechanical meter creeps.

(b) A metering installation is found upon any test to have an average inaccuracy of more than 2.0%.

~~(c) A demand metering installation is found upon any test to have an average inaccuracy of more than 1.0% in addition to the inaccuracies allowed under R 460.3609.~~

(d) A meter registration has been found to be inaccurate due to apparent tampering by a person or persons known or unknown.

(2) The amount of the adjustment of the bills for service must be calculated on the basis that the metering equipment is 100% accurate with respect to the testing equipment used to make the test. The average accuracy of watt-hour meters must be calculated in

Commented [A3]: DTEE - Updated standard price and added ANSI std for higher accuracy meters.

Commented [A4]: DTEE - Creep is specific to electro-mechanical meters only.

accordance with R 460.3616.

(3) If the date when the inaccuracy in registration began can be determined, then that date must be the starting point for determining the amount of the adjustment and is subject to R 460.115.

(4) If the date when the inaccuracy in registration cannot be determined, then it is assumed that the inaccuracy existed for the period of time immediately preceding discovery of the inaccuracy that is equal to 1/2 of the time since the meter was installed on the present premises, 1/2 of the time since the last test, or 6 years, whichever is the shortest period of time, except as otherwise provided in subrule (5) of this rule ~~and subject to subrule (12) of this rule~~.

(5) ELECTRO-MECHANICAL: The inaccuracy in registration due to creep must be calculated by timing the rate of the creeping under R 460.3607 and by assuming that the creeping affected the registration of the meter for the period of time immediately preceding discovery of the inaccuracy that is equal to 1/4 of the time since the meter was installed on the present premises, 1/4 of the time since the last test, or 6 years, whichever is the shortest period of time~~, subject to subrule (12) of this rule~~.

(6) If the average inaccuracy cannot be determined by test because part, or all, of the metering equipment is inoperative, then the utility may use the registration of check metering installations, if any, or estimate the quantity of energy consumed based on available data. The utility shall advise the customer of the metering equipment failure and of the basis for the estimate of the quantity billed. The same periods of inaccuracy must be used as explained in this rule.

(7) Recalculation of bills must be on the basis of the recalculated monthly consumption.

(8) Refunds must be made to the 2 most recent customers who received service through the meter found to be inaccurate. If a former customer of the utility, a notice of the amount of the refund must be mailed to such customer at the last known address. The utility shall, upon demand made by the customer within 3 months of mailing of the notice, forward the refund to the customer.

(9) If the external meter display is not operating so that the customer can determine the energy used, but the meter is recording energy correctly, then no adjustment is required. The utility shall repair or replace the meter promptly upon discovery of the failure.

History: 1983 AACS; 1996 AACS; 2008 AACS; 2019 AACS.

PART 6. METERING EQUIPMENT INSPECTIONS AND TESTS

R 460.3601 Customer-requested meter tests.

Rule 601. (1) Upon request by a customer to a utility, a utility shall make a test of the meter serving the customer. Any charge to the customer shall conform with the utility's filed and approved rates and rules. Provided, however, that the utility need not make more than 1 test in any 12-month period.

(2) The customer, or his or her representative, may be present when his or her meter is tested.

(3) A report of the results of the test shall be made to the customer within a reasonable time after the completion of the test, and a record of the report, together with

a complete record of each test, shall be kept on file at the office of the utility.

History: 1983 AACS.

R 460.3602 Meter and associated device inspections and tests; certification of accuracy.

Rule 602. Every meter shall be inspected and tested, and associated device(s) shall be inspected, in the meter shop of the utility, or a meter testing facility certified by the utility, before being placed in service. The accuracy of each meter shall be certified to be within the tolerances permitted by these rules, except that the utility may rely on the certification of accuracy by the manufacturer on all new meters.

History: 1983 AACS; 2008 AACS.

R 460.3603 Meters with transformers; post-installation inspection; exception.

Rule 603. Meters with associated instrument transformers and phase shifting transformers shall be inspected to determine the proper operation and wiring connections. Inspections shall be made within 60 days after installation by a qualified person who, when possible, should be someone other than the original installer. All self-contained, socket-type meters are excluded from post-installation inspections, except that the original installation shall be inspected when the meter is installed.

History: 1983 AACS.

R 460.3604 Meters and associated devices; removal tests.

Rule 604. All meters and associated devices shall be tested after they are removed from service unless they are retired because of obsolescence.

History: 1983 AACS; 1995 AACS.

R 460.3605 Metering electrical quantities.

Rule 605. (1) All electrical quantities that are to be metered ~~as provided in R 460.3301~~ must be metered by commercially acceptable instruments which are owned and maintained by the utility.

(2) Every reasonable effort must be made to measure at 1 point all the electrical quantities necessary for billing a customer under a given rate.

(3) ELECTRO-MECHANICAL: Metering facilities located at any point where energy may flow in either direction and where the quantities measured are used for billing purposes shall consist of meters equipped with ratchets or other devices to prevent reverse registration and shall be so connected as to separately meter the energy flow in each direction, unless used to implement a utility tariff approved by the commission for service provided under a net metering program.

Commented [A5]: DTEE - R 460.3605 (1), (2) are applicable to all meters, (3), (4), & (5) are specific to electromechanical meters

(4) ELECTRO-MECHANICAL: A utility shall not employ reactive metering for determining the average power factor for billing purposes where energy may flow in either direction or where the customer may generate an appreciable amount of his or her energy requirements at any time, unless suitable directional relays and ratchets are installed to obtain correct registration under all conditions of operation.

(5) ELECTRO-MECHANICAL: All electric service of the same type rendered by a utility under the same rate schedule must be metered with instruments having like characteristics, except that the commission may be requested to approve the use of instruments of different types if their use does not result in unreasonable discrimination. Either all of the reactive meters which may run backwards or none of the reactive meters used for measuring reactive power under 1 schedule must be ratcheted. This rule is only applicable to equipment owned by the utility.

History: 1983 AACS; 2008 AACS; 2019 AACS.

R 460.3606 Nondirect reading meters and meters operating from instrument transformers; ~~marking of multiplier on instruments; marking of charts and magnetic tapes; marking of register ratio on meter registers;~~ watthour constants.

Rule 606. (1) Meters that are not direct reading and meters operating from instrument transformers must have the multiplier plainly marked on the dial of the instrument or otherwise suitably marked. ~~All charts and magnetic tapes taken from recording meters must be marked with the date of the record, the meter number, customer, and chart multiplier, except as in R 460.3304.~~

(2) ~~The register ratio must be marked on all meter registers.~~

(3) The watthour constant (K sub h) for the meter itself must be displayed ~~shown~~ on all watthour meter nameplates.

Commented [A6]: DTEE - Kh detail added here. It is industry standard to have Kh on the nameplate.

History: 1983 AACS; 2019 AACS.

R 460.3607 Watt-hour meter requirements.

Rule 607. (1) Watthour meters that are used for measuring electrical quantities supplied shall conform to ANSI C12.1 and C12.20 specifications and meet all of the following requirements:

(a) Be of proper design for the circuit on which the meters are used; be in good mechanical and electrical condition; and have adequate insulation, correct internal connections, and correct register.

(b) ELECTRO-MECHANICAL: Not creep at no load with all load wires disconnected at a rate of one complete revolution of the moving element in ten minutes when potential is impressed.

Commented [A7]: DTEE - specific to Electromechanical only

(c) Be accurate to within plus or minus 1.0% for electro-mechanical meters and 0.8% for solid state meters, referred to the portable standard watthour meter as a base, at two unity power factor loads: light load (~~l.l.~~ L.L.) and ~~heavy~~ full load (~~h.l.~~ F.L.).

Commented [A8]: DTEE

~~Meter Must be Accurate within ± 1.0% to Portable Standard~~			
Meter Class	Light Load Test Amperes	Heavy Load Test Amperes	Inductive Load 50% Lagging Power Factor Test Amperes
Self-Contained	10% Rated Test Amperes of Meter	~~75-~~ 100% Rated Test Amperes of Meter	~~75-~~ 100% Rated Test Amperes of Meter
Transformer Rated	~~5-~~10% Rated Test Amperes of Meter	~~75-~~ 100% Rated Test Amperes of meter	~~75-~~ 100% Rated Test Amperes of meter

(d) Be accurate to within plus or minus 2.0% for electro-mechanical meters and 1.6% for solid state meters, referred to the portable standard watthour meter as a base, at inductive load (~~i.~~ I.L.).

(2) Polyphase meters shall have their elements in balance within 2.0% at rated test amperes at unity power factor and at approximately 50% lagging power factor.

(3) ~~Meters that are used with instrument transformers shall be adjusted so that the overall accuracy of the metering installation meets the requirements of this rule~~.

(4) ~~Meters and associated devices shall be adjusted as close as practical to zero error and within the accuracy limits specified in subrule (1)(c) of this rule~~.

History: 1983 AACS; 2008 AACS.

R 460.3608 Electro-mechanical ~~D~~demand meters, registers, and attachments; requirements.

Rule 608. A meter that records, or is capable of recording electric demand, is subject to the requirements of this rule. A demand meter, demand register, or demand attachment that is used to measure a customer's service shall meet all of the following requirements:

(a) Be in good mechanical and electrical condition.

(b) ~~Have proper constants, indicating scale, contact device, recording tape or chart, and resetting device~~.

(c) Not register at no load.

(d) ~~Curve-drawing meters that record quantity-time curves and integrated demand meters must be accurate to within plus or minus 2.0% of full scale throughout their working range. Timing elements measuring specific demand intervals must be accurate to within plus or minus 2.0%, and the timing element which serves to provide a record of the time of day when the demand occurs must be accurate to within plus or minus 4 minutes in 24 hours~~.

History: 1983 AACS; 2019 AACS.

R 460.3609 Instrument transformers used in conjunction with metering equipment; requirements; ~~phase shifting transformers; secondary voltage~~.

Rule 609. (1) Instrument transformers used in conjunction with metering equipment to measure a customer's service shall meet both of the following requirements:

(a) Be in proper mechanical condition and have satisfactory electrical insulation for the service on which used.

(b) Instrument transformers shall meet metering accuracy class 0.3 as defined in IEEE/ANSI C57.13-2016 and accuracy class 0.15 as defined in IEEE Std. C57.13.6-2005. ~~Have characteristics such that the combined inaccuracies of all transformers supplying 1 or more meters in a given installation will not exceed the percentages listed in the following chart~~:

~~100% Power 50%~~
~~Factor Power Factor~~

Commented [A9]: DTEE - Added ANSI standard for higher accuracy instrument transformers.

~~Current Error 1%~~	~~10% 0.75%~~	~~100% 3%~~	~~10% 2%~~	~~100%~~

~~(2) Meters that are used in conjunction with instrument transformers shall be adjusted so that the overall accuracies will come within the limits specified in this part.~~

~~(3) Instrument transformers shall be tested with the meter with which they are associated by making an overall test or may be checked separately. If the transformers are tested separately, the meters shall also be checked to see that the overall accuracy of the installation is within the prescribed accuracy requirements. (See R 460.3613 (6).)~~

(4) The results of tests of instrument transformers shall be kept on record and shall be available for use.

~~(5) Phase shifting transformers shall have secondary voltages under balanced line voltage conditions within plus or minus 1.0% of the voltage impressed on the primary side of the transformer.~~

History: 1983 AACS; 2008 AACS.

R 460.3610 Portable indicating voltmeters; accuracy.

Rule 610. All portable indicating voltmeters that are used for determining the quality of service voltage to customers shall be checked against a suitable secondary reference standard at least once every 6 months for electro-mechanical ~~analog~~ devices, and once every 12 months for solid state ~~digital~~ devices. The accuracy of these voltmeters shall be rated so that the error of the indication is not more than plus or minus 1% of full scale. If the portable indicating voltmeter is found to be in error by more than the rated accuracy at commonly used scale deflections, it shall be adjusted.

History: 1983 AACS; 2008 AACS.

R 460.3611 Meter testing equipment; availability; provision and use of primary standards.

Rule 611. (1) A utility shall maintain sufficient laboratories, meter testing shops, secondary standards, instruments, and facilities to determine the accuracy of all types of meters and measuring devices used by the utility. The utility may, if necessary, have all or part of the required tests made, or its portable testing equipment checked, by another utility or agency which uses standards with traceable accuracies to the United States National Institute of Standards and Technology (NIST) or National Research Council (NRC) Canada ~~is approved by the commission~~ and which has adequate and sufficient testing equipment to comply with these rules if approved by the commission.

Commented [A10]: Detail added. DTEE has the capability and maintains traceability to NIST or NRC

(2) At a minimum, a utility shall keep all of the following testing equipment available:

(a) One or more portable standard watthour meters that has a capacity and voltage range which is adequate to test all watthour meters used by the utility.

(b) Portable indicating instruments that are necessary to determine the accuracy of all instruments used by the utility.

(c) One or more secondary standards to check each of the various types of portable

standard watthour meters used for testing watthour meters. Each secondary standard shall consist of an approved portable standard watthour meter which is kept permanently at 1 point and which is not used for fieldwork. Standards shall be well-compensated for both classes of temperature errors, shall be practically free from errors due to ordinary voltage variations, and shall be free from erratic registration due to any cause.

(d) Suitable standards, which are not used for fieldwork, to check portable instruments used in testing.

(3) A utility shall provide and use primary standards that have accuracies which are traceable to the United States National Institute of Standards and Technology (NIST) or National Research Council (NRC) Canada.

Commented [A11]: DTEE - NRC has been added due to the fact that NIST doesn't provide the option.

History: 1983 AACS; 1995 AACS.

R 460.3612 Test standards; accuracy.

Rule 612. (1) The accuracies of all primary reference standards shall be certified as traceable to the National Institute of Standards and Technology (NIST) or National Research Council (NRC) Canada, either directly or through other recognized standards laboratories. These standards shall have their accuracy certified at the time of purchase. Standard cells shall be intercompared regularly and at least 1 standard cell shall be checked by a standardizing laboratory at intervals of not more than 2 years. Reference standards of resistance, potentiometers, and volt boxes shall be checked at intervals of not more than 3 years.

Commented [A12]: DTEE - NRC has been added due to the fact that NIST doesn't provide the option.

(2) Secondary watthour meter standards shall not be in error by more than plus or minus 0.3% at loads and voltages at which they are to be used, and shall not be used to check or calibrate working standards, unless the secondary standard has been checked and adjusted, if necessary, within the preceding 6 months. Each secondary standard watthour meter shall have calibration data available and shall have a history card.

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

(4) Regularly used working portable standard watthour meters shall be compared with a secondary standard at least once every 6 months. Infrequently used working standards shall be compared with a secondary standard before they are used.

(5) Working portable standard watthour meters shall be adjusted so that their percent registration is within 99.7% and 100.3% at 100% power factor and within 99.5% and 100.5% at 50% lagging power factor at all voltages and loads at which the standard may be used. A history and calibration record shall be kept for each working standard.

(6) The meter accuracies required in this rule for all primary, secondary, and working standards shall be referred to 100%. Service measuring equipment shall be

adjusted to within the accuracies required assuming the portable test equipment to be 100% accurate with the calibration correction taken into consideration.

History: 1983 AACS; 1995 AACS; 2008 AACS.

R 460.3613 Solid state ~~M~~meter and metering equipment testing requirements.

Rule 613. (1) The testing of any unit of metering equipment must consist of a comparison of its accuracy with a standard of known accuracy. Units that are not properly connected or that do not meet the accuracy or other requirements of these meter and metering equipment rules at the time of testing shall be reconnected or rebuilt to meet such requirements and must be adjusted to within the required accuracy and as close to zero error as practicable or else their use shall be discontinued.

(2) All solid state single-phase, three-phase, network, self-contained and transformer rated meters must be in compliance with all of the following requirements.

(a) Be checked for accuracy as provided for in R 460.3602.

(b) Notwithstanding the provisions of subdivision (a) of this subrule, upon application to the commission and upon receipt of an order granting approval, the testing of self-contained, solid state, single-phase, and network meters and all self-contained and transformer-rated, solid state, 3-phase meters in service must be governed by a quality control plan as follows:

(i) Meters must be divided into homogenous groups by manufacturers' types, and certain manufacturers' types must be further subdivided into separate groups by manufacturers' serial numbers.

(ii) The meters in each homogeneous group must then be further subdivided into lots of not less than 301, and not more than 35,000, meters each, except that meters of the most recent design may be combined into lots regardless of manufacturers' type, except that where the number of meters of a single type is 8,001 or more, that number of meters must be segregated by types for the formation of lots.

(iii) From each assembled lot, a sample of the size specified in table A-2, ANSI/ASQC Z1.9-2003(R2018) using general inspection level II, must be drawn annually. The sample must be drawn at random.

(iv) The meters in each sample must be tested for accuracy pursuant to paragraphs (v) to (xi) of this subdivision.

(v) The test criteria for acceptance or rejection of each lot must be based on the test at heavy load only and must be that designated for double specification limits and an acceptable quality level (AQL) that is not higher than 2.50 (normal inspection) as shown in table B-3, ANSI/ASQC Z1.9-2003(R2018).

(vi) The necessary calculations must be made pursuant to Example B-3 of ANSI/ASQC Z1.9-2003(R2018). The upper and lower specification limits, U and L, must be 102% and 98%, respectively.

(vii) A lot must be rejected if the total estimated percent defective (p) exceeds the appropriate maximum allowable percent defective (M) as determined from table B-3 as specified in paragraph (v) of this subdivision.

(viii) All meters in a rejected lot must be tested within a maximum period of 60 months and be adjusted pursuant to the provisions of R 460.3607 or be replaced with meters that are in compliance with the requirements of R 460.3607.

(ix) During each calendar year, new meter samples must be drawn as specified in this subdivision from all meters in service, with the exception that lots that have been rejected must be excluded from the sampling procedure until all meters included in the rejected lots have been tested.

(x) The utility may elect to adopt the following sample plan for lots that have been rejected the previous year.

(a) From rejected lots, a sample of the lot size specified in table A-2, ANSI/ASQ Z1.9-2003(R2018) using general inspection level III, must be drawn at random**.**

(b) The test criteria for acceptance or rejection of each lot must be based on the test at heavy load and must be that designated for double specification limits and an acceptable quality level (AQL) that is not higher than 2.50 (tightened inspection) as shown in Table B-3 of ANSI/ASQ Z1.9-2003(R2018).

(c) The necessary calculations must be made pursuant to Example B-3 of ANSI/ASQ Z1.9-2003(R2018). The upper and lower specification limits, U and L, must be 102% and 98% respectively.

(d) A lot must be rejected if the total estimated percent defective (p) exceeds the appropriate maximum allowable percent defective (M) as determined from Table B-3 specified in paragraph (b)of this subdivision. If the acceptability criteria of the sampling plan are met, then the lot shall be considered acceptable and shall be returned to the variables sampling plan the following year. If the acceptability criteria of the sampling plan are not met, then the utility shall reject that lot and all meters in that lot must be tested and adjusted or replaced within a maximum period of 48 months after the second rejection

(3) The utility must adhere to the quality control plan switching procedures as described below:

(a)Tightened to Normal: When tightened inspection is in effect, normal inspection shall be instituted when all lots have been considered acceptable on original inspection in preceding two years. The utility must adhere to quality control plan as provided in Rule 613 (2)(b).

(b) Normal to Reduced: When normal inspection is in effect, reduced inspection shall be instituted providing that all of the following conditions are satisfied.

(i) The normal inspection is in effect preceding three years.

(ii) All lots of same manufacture meter type have been accepted on normal inspection in preceding three years. The reduced inspection must adhere to a quality plan as follows.

(iii) All in service meters must be divided into homogenous groups by manufacturers' types, and certain manufacturers' types must be further subdivided into separate groups by manufacturers' serial numbers.

(iv)The meters in each homogeneous group must then be further subdivided into lots of not less than 301, and not more than 35,000, meters each, except that meters of the most recent design may be combined into lots regardless of manufacturers' type, except that where the number of meters of a single type is 8,001 or more, that number of meters must be segregated by types for the formation of lots.

(v) From each assembled lot, a sample of the lot size specified in table A-2, ANSI/ASQ Z1.9-2003(R2018) using general inspection level I, must be drawn annually. The sample must be drawn at random**.**

(vi) The meters in each sample must be tested for accuracy pursuant to paragraphs (v) to (ix) of this subdivision.

(vii) The test criteria for acceptance or rejection of each lot must be based on the

test at heavy load only and must be that designated for double specification limits and an acceptable quality level (AQL) that is not higher than 2.50 (reduced inspection) as shown in table B-4, ANSI/ASQ Z1.9-2003(R2018).

(viii) The necessary calculations must be made pursuant to Example B-3 of ANSI/ASQ Z1.9-2003(R2018). The upper and lower specification limits, U and L, must be 102% and 98%, respectively.

(ix) A lot must be rejected if the total estimated percent defective (p) exceeds the appropriate maximum allowable percent defective (M) as determined from table B-4 as specified in paragraph (v) of this subdivision.

(c) Reduced to Normal**:** When reduced inspection is in effect, normal inspection shall be instituted if a lot is rejected on original inspection. The normal inspection is invoked. The utility must adhere to quality control plan as provided in Rule 613 (2)(b).

(i) Continuation of Inspection: Normal, tightened, or reduced inspection shall continue unchanged except where the above switching procedures require change.

(4) The quality control plan specified in rule 613 (2)(b) does not alter the rules under which customers may request special tests of meters.

(5) All solid-state meters must be in compliance with all of the following requirements:

(a) Be checked for accuracy in all of the following situations:

(i) When a meter is suspected of being inaccurate or damaged.

(ii) When the accuracy of a meter is questioned by a customer. (See R 460.3601.)

(b) Be inspected for electrical faults when the accuracy of the device is checked.

(c) Have the connections to the customer's circuits checked when the meter is tested on the premises or when removed for testing.

(d) A meter need not be tested or checked for any reason if the device was tested and checked within the previous 12 months except when a complaint is received.

(e) Before use when a meter has been inactive for more than 1 year after having been in service.

(6) All transformer rated solid-state meters must be in compliance with all of the following requirements:

(a) Have the connections to the customer's circuits and multipliers checked when the equipment is tested for accuracy on the customer's premises.

(b) On the customer's premises within 60 days after installation, unless the transformers are in compliance with the specifications outlined in the American National Standards Institute standard ANSI C-57.13.

(c) Have the connections to the customer's circuits and multipliers checked when the equipment is tested for accuracy on the premises or when removed for testing and when instrument transformers are changed.

R 460.3613a Electro-mechanical ~~M~~meter and metering equipment testing requirements.

Rule 613. (1) The testing of any unit of metering equipment must consist of a comparison of its accuracy with a standard of known accuracy. Units that are not properly connected or that do not meet the accuracy or other requirements of these meter and metering equipment rules at the time of testing shall be reconnected or rebuilt to meet such requirements and must be adjusted to within the required accuracy and as close to zero error as practicable or else their use shall be discontinued.

(2) Self-contained, electro-mechanical, combination electro-mechanical and solid state, solid state, single-phase, and all network meters must be in compliance with all of the following requirements:

(a) Be checked for accuracy as provided for in R 460.3602.

(b) Notwithstanding the provisions of subdivision (a) of this subrule, upon application to the commission and upon receipt of an order granting approval, the testing of self-contained, electro-mechanical, solid state, single-phase, and all network meters in service must be governed by a quality control plan as follows:

(i) Meters must be divided into homogenous groups by manufacturers' types, and certain manufacturers' types must be further subdivided into separate groups by manufacturers' serial numbers.

(ii) The meters in each homogeneous group must then be further subdivided into lots of not less than 301, and not more than 35,000, meters each, except that meters of the most recent design may be combined into lots regardless of manufacturers' type, except that where the number of meters of a single type is 8,001 or more, that number of meters must be segregated by types for the formation of lots.

(iii) From each assembled lot, a sample of the size specified in table A-2, ANSI/ASQC Z1.9, must be drawn annually. The sample must be drawn at random.

(iv) The meters in each sample must be tested for accuracy pursuant to paragraphs (v) to (xi) of this subdivision.

(v) The test criteria for acceptance or rejection of each lot must be based on the test at heavy load only and must be that designated for double specification limits and an acceptable quality level (AQL) that is not higher than 2.50 (normal inspection) as shown in table B-3, ANSI/ASQC Z1.9.

(vi) The necessary calculations must be made pursuant to Example B-3 of ANSI/ASQC Z1.9. The upper and lower specification limits, U and L, must be 102% and 98%, respectively.

(vii) A lot must be rejected if the total estimated percent defective (p) exceeds the appropriate maximum allowable percent defective (M) as determined from table B-3 as specified in paragraph (v) of this subdivision.

(viii) All meters in a rejected lot must be tested within a maximum period of 60 months and be adjusted pursuant to the provisions of R 460.3607 or be replaced with meters that are in compliance with the requirements of R 460.3607.

(ix) During each calendar year, new meter samples must be drawn as specified in this subdivision from all meters in service, with the exception that lots that have been rejected must be excluded from the sampling procedure until all meters included in the rejected lots have been tested.

(x) The utility may elect to adopt the following sample plan for lots that have been rejected the previous year.~~a mixed variables-attributes sampling plan as outlined in Section A9 of ANSI/ASQC Z1.9, in which case, a lot that is not in compliance with the acceptability criteria of the variables sampling plan shall be resampled the following year using an attributes sampling plan. If the acceptability criteria of the attributes sampling plan are met, then the lot shall be considered acceptable and shall be returned to the variables sampling plan the following year. If the acceptability criteria of the attributes sampling plan are not met, then the utility shall reject that lot and all meters in the lot must be tested and adjusted or replaced within a maximum period of 48 months after the second rejection.~~

(a) From each rejected lot, a sample of the lot size specified in table A-2, ANSI/ASQ Z1.9-2003(R2018) using general inspection level III, must be drawn at random.

(b) The test criteria for acceptance or rejection of each lot must be based on the test at heavy load and must be that designated for double specification limits and an acceptable quality level (AQL) that is not higher than 2.50 (tightened inspection) as shown in Table B-3 of ANSI/ASQ Z1.9-2003(R2018).

(c) The necessary calculations must be made pursuant to Example B-3 of ANSI/ASQ Z1.9-2003(R2018). The upper and lower specification limits, U and L, must be 102% and 98% respectively.

(d) A lot must be rejected if the total estimated percent defective (p) exceeds the appropriate maximum allowable percent defective (M) as determined from Table B-3 specified in paragraph (b)of this subdivision. If the acceptability criteria of the sampling plan are met, then the lot shall be considered acceptable and shall be returned to the variables sampling plan the following year. If the acceptability criteria of the sampling plan are not met, then the utility shall reject that lot and all meters in that lot must be tested and adjusted or replaced within a maximum period of 48 months after the second rejection

(xi) The plan specified in paragraph (x) of this subdivision does not alter the rules under which customers may request special tests of meters.

(c) Be checked for accuracy in all of the following situations:

(i) When a meter is suspected of being inaccurate or damaged.

(ii) When the accuracy of a meter is questioned by a customer. (See R 460.3601.)

(d) Be inspected for mechanical and electrical faults when the accuracy of the device is checked.

(e) Have the register and the internal connections checked before the meter is first placed in service and when the meter is repaired.

(f) Have the connections to the customer's circuits checked when the meter is tested on the premises or when removed for testing.

(g) A meter need not be tested or checked for any reason if the device was tested, checked, and adjusted within the previous 12 months except when a complaint is received.

(3) All single-phase transformer-~~instrument~~ rated electro-mechanical meters must be in compliance with all of the following requirements:

(a) Be checked for accuracy at unity power factor at the point where a meter is installed, at a central testing point, or in a mobile testing laboratory as follows:

(i) Not later than 9 months after 144 months of service for a surge-resistant meter and not later than 9 months after 96 months of service for a non-surge-resistant meter.

(ii) When a meter is suspected of being inaccurate or damaged.

(iii) When the accuracy of a meter is questioned by a customer. (See R 460.3601.)

(iv) Before use when a meter has been inactive for more than 1 year after having been in service.

(b) Be inspected for mechanical and electrical faults when the accuracy of the device is checked.

(c) Have the register and the internal connections checked before the meter is first placed in service and when the meter is repaired.

(d) Have the connections to the customer's circuits checked when the meter is tested on the premises or when removed for testing.

(e) Be checked for accuracy at 50% power factor when purchased and after rebuilding.

(f) A meter need not be tested or checked for any reason if the device was tested, checked, and adjusted within the previous 12 months except when a complaint is received.

(4) All self-contained electro-mechanical, combination electro-mechanical and solid-state, and solid state 3-phase meters and associated equipment must be in compliance with all of the following requirements. However, a utility may elect to include self-contained solid state 3-phase meters in service in its quality control plan as provided for in R 460.3613(2)(b). Therefore, a utility may be exempt from the periodic meter test requirements as provided in subdivision (a)(ii) of this subrule.

(a) Be tested for accuracy at unity and 50% power factor as follows:

(i) Before being placed in service.

(ii) Not later than 9 months after 120 months of service.

(iii) When a meter is suspected of being inaccurate or damaged.

(iv) When the accuracy of a meter is questioned by a customer. (See R 460.3601.)

(v) When a meter is removed and put back in service.

(b) Be inspected for mechanical and electrical faults when the accuracy is checked.

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

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

(5) All transformer-rated electro-mechanical, combination electro-mechanical and solid state, and solid state 3-phase meters and associated equipment must be in compliance with all of the following requirements. However, a utility may elect to include transformer-rated solid state 3-phase meters in service in its quality control plan as provided for in R 460.3613(2)(b). Therefore, a utility may be exempt from the periodic meter test requirements as provided in subdivision (a)(iii) of this subrule.

(a) Be checked for accuracy at unity and 50% power factor as follows:

(i) Before being placed in service.

(ii) On the customer's premises within 60 days after installation, unless the transformers are in compliance with the specifications outlined in the American National Standards Institute standard ANSI C-57.13, and unless the meter adjustment limits do not exceed plus or minus 1.5% at 50% power factor.

(iii) Not later than 9 months after 72 months of service.

(iv) When a meter is suspected of being inaccurate or damaged.

(v) When the accuracy is questioned by a customer. (See R 460.3601.)

(vi) When a meter is removed and put back in service.

(b) Be inspected for mechanical and electrical faults when the accuracy is checked.

(c) Have the register and internal connections checked before the meter is first placed in service and when the meter is repaired.

(d) Have the connections to the customer's circuits and multipliers checked when the equipment is tested for accuracy on the premises or when removed for testing and when instrument transformers are changed.

(e) Be checked for accuracy at 50% power factor when purchased and after

rebuilding.

~~(6) A utility shall test instrument transformers in all of the following situations:~~

~~(a) When first received, unless a transformer is accompanied by a certified test report by the manufacturer.~~

~~(b) When removed and put back in service.~~

~~(c) Upon complaint.~~

~~(d) When there is evidence of damage.~~

~~(e) When an approved check, such as the variable burden method in the case of current transformers that is made when the meter is tested indicates that a quantitative test is required.~~

~~(7) Demand meters must be in compliance with both of the following requirements:~~

~~(a) Be tested for accuracy in all of the following situations:~~

~~(i) Before a meter is placed in service.~~

~~(ii) When an associated meter is tested and the demand meter is a block interval nonrecording type or a thermal type.~~

~~(iii) After 2 years of service if the meter is of the recording type, but testing is not required if the meter is of the pulse-operated type and the demand reading is checked with the kilowatt-hour reading each billing cycle.~~

~~(iv) When a meter is suspected of being inaccurate or damaged.~~

~~(v) When the accuracy is questioned by a customer. (See R 460.3601.)~~

~~(b) Be inspected for mechanical and electrical faults when a meter is tested in the field or in the meter shop.~~

History: 1983 AACS; 1995 AACS; 2008 AACS; 2019 AACS.

R 460.3614 Standards check by the commission.

Rule 614. (1) Upon request of the commission, a utility shall submit 1 of its portable standard watthour meters and 1 portable indicating voltmeter, ammeter, and wattmeter to a commission-approved standards laboratory for checking of their accuracy.

(2) A utility shall normally check its own working portable standard watthour meters or instruments against primary or secondary standards and shall calibrate these working standards or instruments before they are submitted with a record of such calibration attached to each of the working standards or instruments.

History: 1983 AACS.

R 460.3615 Metering equipment records.

Rule 615. (1) A utility shall maintain a complete record of the most recent test of all metering equipment. The record must show all of the following information:

(a) Identification and location of unit.

(b) Equipment with which the device is associated.

(c) The date of test.

(d) Reason for the test.

(e) Readings before and after the test.

(f) ELECTRO-MECHANICAL: A statement as to whether or not the meter creeps and, in case of creeping, the rate.

(g) A statement of meter accuracies before and after adjustment sufficiently complete to permit checking of the calculations employed.

(h) Indications showing that all required checks have been made.

(i) A statement of repairs made, if any.

(j) Identification of the testing standard and the person making the test.

(k) Communications type

(l) Filmware history

(2) The utility shall also keep a record of each unit of metering equipment which shows all of the following information:

(a) When the unit was purchased.

(b) The unit's cost.

(c) The company's identification.

(d) Associated equipment.

(e) Essential nameplate data.

(f) The date of the last test. The record must also show either the present service location with the date of installation or, if removed from service, the service location from which the unit was removed with the date of removal.

History: 1983 AACS; 2019 AACS.

R 460.3616 Average meter error; determination.

Rule 616. If a metering installation is found upon any test to be in error by more than 2% at any test load, the average error shall be determined in 1 of the following ways:

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

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

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

(d) If a load, other than the light, heavy, and low power factor load specified for routine testing, is more representative of the customary use of the metering equipment, its error at that load shall also be determined. In this case, the average error shall be computed by giving the error at such load and power factor a weighting of 3 and each of the errors at the other loads (light, heavy, and 50% lagging power factor) a weighting of 1. Each error shall be assigned its proper sign.

History: 1983 AACS.

Commented [A13]: DTEE - it is specific to meter, based on PO. Stored in ERP & IS-U

Commented [A14]: DTEE - To confirm that it refers to FW- Firmware. Digital meters may have multiple FWs such as: metrology, radio frequency communication, cellular communication, zigbee. Individual meters FW historical data is not available. Need clarification.

R 460.3617 Reports to be filed with the commission.

Rule 617. (1) A utility shall file, with the commission, within 30 days after the first day of January of each year, an officer-certified statement that the utility has complied with all of the requirements set forth in these rules relating to meter standardizing equipment.

(2) For all meters that are not included in the provisions of R 460.3613(2)(b), the utility shall file, with the commission, on or before the first day of April of each year, its annual tabulation of all of its prior-to-adjustment meter test results covering the 12-month period ending December 31. The utility shall summarize, by meter type, all individual meters and overall light and heavy load prior-to-adjustment test results at the power factors required by these rules. The summary shall be divided into

heavy load 100% power factor, light load 100% power factor, and heavy load 50% power factor test results and shall also be divided according to the length of meter test period and types of single-phase and polyphase meters. The summary shall show the number of meters or overall tests found within each of the following accuracy classifications:

(a) No recording.
(b) ELECTRO-MECHANICAL: Creeping.
(c) Equal to or less than 94.0%.
(d) 94.1 to 96.0%.
(e) 96.1 to 97.0%.
(f) 97.1 to 98.0%.
(g) 98.1 to 99.0%.
(h) 99.1 to 100.0%.
(i) 100.1 to 101.0%.
(j) 101.1 to 102.0%.
(k) 102.1 to 103.0%.
(l) 103.1 to 104.0%.
(m) 104.1 to 106.0%.
(n) Over 106.0%.

When a utility is subject to multiple state jurisdiction, these accuracy classifications may be modified with the approval of the commission.

(3) For all meters that are included in the provisions of R 460.3613(2)(b), the utility shall file, with the commission, on or before the first day of April, all of the following information:

(a) A summary of all samples of meter lots that pass the acceptability criteria as set forth in ANSI/ASQC Z1.9-1980, including complete data on all of the following:

(i) The type of meter.
(ii) The number of meters in a lot.
(iii) The size of the sample.
(iv) The average months in service since the last test.
(v) The computed p (total estimated percent defective in lot).
(vi) The corresponding M (maximum allowable percent defective) as determined from table B-3 in ANSI/ASQC Z1.9-1980.

(b) The necessary calculations made pursuant to Example B-3 of ANSI/ASQC Z1.9-1980 shall be retained for each sample or resample drawn. In addition to the actual computation, the data shall include all of the following:

(i) The type of meter.
(ii) The number of meters in the lot.
(iii)The meter numbers of sample meters.
(iv) The actual prior-to-adjustment test data of each meter tested.
(v) The number of months since the last test for each meter in the sample.

A sample of the calculations and data for a lot that passes the acceptability criteria shall be included in the report to the commission.

(c) A copy of the complete data, as outlined in this subrule, shall be included for each meter lot that is not in compliance with the acceptability criteria of the sampling plan employed as set forth in ANSI/ASQC Z1.9-1980.

(d) A report summarizing the testing of all meters in rejected lots that are to be returned to service. The heavy load preadjustment tests only shall be recorded, and the accuracy classifications as established in subrule (2) of this rule shall be used. Each rejected lot shall be reported separately and shall be separated into groups by the number of months since the last test as follows:

(i) 0 to 48 months.
(ii) 49 to 72 months.
(iii) 73 to 96 months.
(iv) More than 96 months.

History: 1983 AACS; 1995 AACS.

R 460.3618 Generating and interchange station meter tests; schedule; accuracy limits.

Rule 618. (1) Generating and interchange station and watthour meters shall be tested in conjunction with their associated equipment as follows:

(a) At least once every 24 months for generating station meters.
(b) At least once every 12 months for interchange meters.

(2) The accuracy limits for any particular device shall not be greater than the accuracy limits required elsewhere in these rules.

History: 1983 AACS.