STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-100, SUB 153

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of Commission Rules Related to Electric Metering	))	ORDER REVISING RULES AND REQUIRING ANNUAL REPORTS

BY THE COMMISSION: On August 21, 2017, the Commission issued an Order Initiating Rulemaking Proceeding in the above-captioned docket in which it found that there is good reason to believe that the Commission's rules related to the testing of electric meters require revision. In that Order the Commission made Duke Energy Carolinas, LLC (DEC), and Duke Energy Progress, LLC (DEP) (jointly Duke), and Dominion Energy North Carolina (DENC) parties to the proceeding and established a procedural schedule that included an intervention deadline of November 8, 2017, and subsequent deadlines for comments and reply comments. The Commission invited parties and interested persons to file proposed rules, rule revisions, or any comments or suggestions to assist the Commission in drafting rules to update and replace Commission Rules R8-7 through R8-14, and Rule R8-21.

On October 12, 2017, the Public Staff filed a Motion to Hold Proceeding in Abeyance, which Motion was granted on October 24, 2017.

On June 22, 2018, the Commission issued an Order Approving Manually Read Meter Rider with Modifications and Requesting Meter-Related Information (MRM Order). Among other things, that Order required DEC to submit verified responses to questions regarding meter testing by September 4, 2018. In that Order, the Commission also required DEC to include in its annual Smart Grid Technology Plan filing "details of smart meter malfunctions or problems, data on the number of customers on Rider MRM, and a verified statement about its meter data privacy procedures…." MRM Order, at 15.

On August 29, 2018, DEC filed some of the information that the Commission sought.

On November 19, 2018, the Commission issued an Order Scheduling Staff Technical Conference and Tour of Meter Testing Facilities in which it required the electric public utilities to file additional information about their meter testing programs. In addition, the Commission scheduled a Staff Technical Conference, which was held December 18, 2018, for the purpose of obtaining additional information from DEC's meter testing experts and the Public Staff. The Commission also directed members of its staff to tour DEC's meter testing facilities by January 1, 2019, and provided that the Public Staff should be invited to attend the tour. The Commission also required all three electric public utilities to file reports explaining: (1) the tests performed by their meter manufacturers; (2) the

tests performed by the utility upon acceptance of new meters; (3) their periodic tests during meter use; and (4) their meter tests conducted pursuant to customer complaints.

On December 5, 2018, DEC and DEP filed the required information, and DENC filed the required information on December 13, 2018. On December 18, 2018, the Staff Technical Conference was held, and on December 20, 2018, staff from the Commission and the Public Staff toured the meter testing facilities at DEC's Little Rock operations center in Charlotte. A copy of the tour presentation materials was filed in this docket on December 21, 2018.

On January 23, 2019, the Commission issued an Order Modifying Program in Docket No. E-2, Sub 834 in which it required DEP, among other things, to include in its annual Smart Grid Technology Plan filing details of smart meter malfunctions or problems, and the number of customers enrolled in each option of Rider MROP (Meter-Related Optional Programs).

On February 4, 2019, the Commission issued an Order Requiring Information, Requesting Comments, and Initiating Rulemaking. That Order provided that parties could file comments, suggestions, and/or draft meter testing rules by April 15, 2019. Subsequently the Commission granted two extensions of time in order to allow the Public Staff, DEC, DEP, and DENC to collaborate on the drafting of revised meter testing rules. On June 14, 2019, those four entities jointly filed comments and proposed rule revisions.

On February 21, 2019, the Commission received a consumer statement from a consumer who opposed DEC's fee for opting out of having an automated metering infrastructure (AMI) meter installed and also advocated for the right to be served via an analog meter. The Commission concludes that these issues are out of the scope of this rulemaking docket, and, therefore, the Commission will not address them here.

On July 10, 2019, the Commission issued an Order Requesting Comments on Proposed Rules and Requiring Additional Revisions in which it required DEC, DEP, DENC, and the Public Staff to file additional rule revisions that would include key provisions from the cited American National Standards Institute (ANSI) standards that are most likely to be of interest to customers. The Order also required parties to address the following questions:

1) How the rules could be amended to address the need to test the two-way communications aspects of AMI.

2) How the rules could be amended to assure the utilities take steps to protect their AMI communications networks from cyber-related vulnerabilities.

3) Whether the Commission should repeal Rule R8-16 (Standard Frequency) in its entirety.

4) Whether it would be more efficient for some or all of the requirements from the Commission's June 22, 2018 MRM Order to be transitioned from the Smart Grid Technology Plan filing into the proposed annual meter testing report.

The July 10, 2019 Order established a schedule for these filings and reply comments and also stated that parties could provide draft revisions to Commission Rule R8-7 (Information for Consumers) and R8-8 (Meter Readings and Bill Forms) in Docket No. E-100, Sub 161, in comments that were due in that docket on July 29, 2019.

On September 16, 2019, the Commission issued an Order Granting Further Extensions of Time in which it granted the Public Staff's motion requesting an extension of time to September 23, 2019, to file additional proposed revisions to the meter testing rules, and an extension of time to October 25, 2019, for parties to file reply comments. In its motion, the Public Staff stated that it had been discussing the proposed rule revisions with the electric utilities, but that the parties needed additional time for further discussions.

On September 23, 2019, joint partial comments and rule revisions were filed by the Public Staff, Duke and DENC. In addition, separate supplemental comments were filed on the same date by the Public Staff, Duke, and DENC.

On October 25, 2019, Duke filed reply comments.

In reviewing the proposed meter testing rules that the parties filed June 14, 2019, the Commission noted that the draft rules referred multiple times to various industry standards,[1] specifically:

- ANSI Standard C12.1 (Code for Electricity Metering)
- ANSI Standard Z1.4 (Sampling Procedures and Tables for Inspection by Attributes)
- ANSI Standard Z1.9 (Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming)

As to ANSI Standard C12.1, the parties stated that this industry standard was revised in 2016 and reflects "electric meter testing best practices." The parties recommended that the Commission's revised meter testing rules rely heavily on this ANSI standard, as well as on ANSI Standard Z1.4 and ANSI Standard Z1.9.

While not requested by the Commission, the parties also offered revisions to Commission Rule R8-16 (Standard Frequency) and R8-17 (Standard Voltage). The proposed revisions to R8-17 would rely heavily on yet another industry standard, ANSI Standard C84.1 (Electric Power Systems and Equipment – Voltage Ratings (60 Hz)).

The Commission's July 10, 2019 Order found that the proposed rules were grounded in the cited ANSI standards, which would ensure that they remained current

[1] The National Electrical Manufacturers Association published the cited standards with the approval of ANSI.

over time. However, since ANSI standards are not in the public domain, such a construct would frustrate members of the public who seek clear, convenient information about North Carolina's electric meter standards. Therefore, in its July 10, 2019 Order, the Commission concluded that it was necessary to require the utilities and the Public Staff to submit additional revisions to their June 14, 2019 proposal, revisions that would recite key provisions from the ANSI standards so as to make the new rules transparent and accessible to consumers.

The revisions filed in the joint partial comments on September 23, 2019, address the Commission's concern. Specifically, proposed revisions to Rule R8-12 (Meter Accuracy), R8-13 (Periodic Tests of Meters), and R8-14 (Meter Testing at Request of Consumers) now state that a watt hour meter must have an "average percent registration not less than 98% or more than 102%." In the proposed rule changes, R8-11 (Method of Determining Average Error of Meters) now lists the four acceptable methods for calculating the average error of a meter, and R8-13 now lists the corrective action options for meters that don't meet the applicable performance criteria. The parties added similar additional details to other portions of the revised rule so that readers can understand their intent without securing a copy of the cited ANSI standards.

As to the communications infrastructure and software used to relay information to and from AMI meters, the Commission sought comments on how to ensure that these systems are performing accurately and are protected against cyberattacks. In particular, the Commission requested comments on the option of requiring the utilities to periodically engage a third party to audit their AMI communications for cyber-related vulnerabilities.

In its September 23, 2019 comments, DENC stated that it does not believe that any additional testing is needed because any AMI communications issues are automatically identified and addressed when DENC does not receive expected data from a meter. DENC stated further that data being transmitted between DENC's smart meters and its "head end" is encrypted using the highest industry cybersecurity standards set by the National Institute of Standards and Technology. DENC stated that each meter has a unique security key that is embedded at the time of manufacturing such that the key is never transmitted over the air. DENC stated further:

> Accordingly, compromising one meter will not allow access to any other meter because of the unique security keys in each device. In addition, each meter holds minimal data – limited to its configuration and the usage data being recorded – and at no time is any customer-identifying information held in or transmitted to a meter.
>
> The access points to which the meters connect are located on a private cellular network, and the connectivity from the cellular carrier to the data center is over dedicated encrypted links. The head end servers are housed in a high[ly] secure data center and protected by firewalls to limit access ….

> [T]he Company does not believe it is necessary for the Commission to require periodic third party audits of its AMI communications.

DENC Comments, at 1.

The Public Staff stated that it understands that no standards are in place in the industry to evaluate/test AMI communications networks, and that electric utilities have procedures in place to accurately read the meters if the two-way communication is not functioning properly. The Public Staff stated that to the extent disconnect/reconnection functionality of AMI meters is not working properly, the electric utilities should include those instances in the discussion of smart meter malfunctions in their annual meter testing reports.

As to the Commission's concerns about cyber-related vulnerabilities, the Public Staff stated that it shares these concerns but suggested that the Commission request information on an ongoing basis directly from the electric utilities so that the information could be provided in a confidential fashion, as appropriate. Also, the Public Staff understands that the electric utilities already engage third parties to audit and perform penetration testing on grid components.

In their comments, Duke stated that the Companies believe it is "unnecessary to include communication testing in the meter testing rules," explaining that prior to the deployment of AMI, they used communicating AMR meters, and no such testing was required for them. Duke stated that the Companies have procedures in place to deal with a situation in which the AMI meters do not communicate, and that they are not aware of standards in the industry for evaluating or testing an AMI communications network. Duke committed to providing in-person cybersecurity briefings to the Commission, including information on the schedule and scope of audits to their AMI systems. In its reply comments, Duke stated that, "the schedule and scope of audits on the AMI system would be more appropriately discussed" in one of those in-person briefings "due to the sensitivity of such critical energy infrastructure information." Duke Comments, at 1. The Commission finds Duke's proposal to be reasonable, and will, therefore, adopt it.

In its July 10, 2019 Order, the Commission sought comments on whether it would be more efficient for DEC to fulfill its smart meter reporting obligations via its new annual meter testing report, rather than in its Smart Grid Technology Plan (SGTP) filing. (DEP is subject to similar, but not identical filing requirements.)[2] In its September 23, 2019 comments, Duke stated that

> [t]he meter testing report already addresses the accuracy and function of the Companies' meters and would include malfunctions or problems, should any exist. Regarding the number of customers on Rider MRM (or MROP), DEC and DEP are tracking the number of customers enrolled and would provide that to the Commission upon request but do not believe it should be

[2] Subsequently, on November 13, 2019, the Commission issued an order in Docket No. E-100, Sub 126, in which it eliminated the rules requiring the annual SGTP filings in their entirety.

> part of the meter testing rule as utilities have not historically reported on the number of customers on other tariffs. The verified statement of an officer is currently only a requirement of DEC, and it references privacy policies and standards [that are] publicly available on the Company's website…. [T]he Companies are unsure of what value the current reporting requirements … would have if the SGTP rule is eliminated. Finally, the Companies believe that, if addressed at all, the meter data privacy procedures would be more properly reviewed in the data access docket, Docket No. E-100, Sub 161.

Duke Comments, at 2.

The filing requirements to which Duke objects have been in place only a short time. Given the negative reaction some customers have had to the DEC and DEP smart meter deployments, the Commission finds that it is premature to rescind the filing requirements. Instead the Commission will sunset them such that Duke is to include the required smart meter information with its annual metering reports for five years. As to the data privacy requirement that applies only to DEC, the Commission will consider this requirement in Docket No. E-100, Sub 161, as Duke suggests.

As requested by the Commission, the parties' proposed Rule R8-13(f) now requires each electric public utility to report annually on its in-service meter testing program, including providing both the results of the previous year's tests as well as an outline of the current year's testing plan. In addition, Proposed Rule R8-13(f) specifies that these annual reports and plans are to be filed by April 1 each year. (DEC and DEP will be required to include in their annual meter testing reports information about their smart meter programs, as discussed above.) The Commission concludes that this is an improvement over the current rules wherein each utility must maintain an approved sampling program on file with the Commission. Under the new rule, finding a utility's current meter testing plan and results will be more straightforward.

The Commission's initial Order establishing this proceeding did not contemplate revisions to R8-16 (Standard Frequency) or R8-17 (Standard Voltage). However, the parties submitted proposals relative to these two rules, and since no party has objected, the Commission will consider them.

The parties initially proposed to rewrite Rule R8-16 (Standard Frequency). Currently this rule states that each utility shall adopt a standard frequency and then operate within plus or minus two percent of that standard frequency. In its July 10, 2019 Order the Commission sought comments on whether it should eliminate Rule R8-16 in its entirety because the Federal Energy Regulatory Commission (FERC) has established a robust reliability standard relative to standard frequency (NERC standard BAL-003-1.1, Frequency Response and Frequency Bias Setting). In their comments, all parties agreed that Rule R8-16 should be repealed. Based on those comments and FERC's jurisdiction over bulk electric system reliability standards, the Commission finds it appropriate to repeal Rule R8-16.

As to R8-17 (Standard Voltage), the parties initially proposed to eliminate the table that currently summarizes the standard nominal voltages that utilities must offer, and instead proposed to incorporate a reference to ANSI Standard C84.1 (Electric Power Systems and Equipment-Voltage Ratings (60 Hz)). In response to the Commission's July 10, 2019 Order, however, the parties now propose to reinsert a chart listing the nominal voltages from ANSI C84.1, which have changed slightly since R8-17 was last updated.

The Commission has reviewed the revised rules that were submitted by the parties on September 23, 2019. No party submitted comments in opposition to any of the proposed changes. In its initial Order Initiating Rulemaking Proceeding in this docket, the Commission noted that it has been more than 50 years since the Commission established the rules now found in Article 3 of Chapter 8 – Electric Light and Power. The Commission finds that the proposed changes are appropriate in light of changes in metering technology and industry standards for meter testing. The Commission finds that the revised rules proposed by the parties strike the appropriate balance by being both accessible to the public and grounded in national industry standards that are updated periodically via a rigorous standard-setting process. However, in several instances, the proposed revisions to Rule R8-17 (Standard Voltage) would replace "electric supplier" with "electric utility." No party provided an explanation for this proposed change, which would have the effect of creating ambiguity as to whether all portions of Rule R8-17 continue to apply to all electric suppliers. The Commission will therefore amend the proposed revisions by replacing "utility" with "electric supplier," so that Rule R8-17 is internally consistent as to its application to all electric suppliers. Therefore, the Commission will adopt the proposed rule changes, including the repeal of Rule R8-16 (Standard Frequency), as reflected in Appendix A of this Order, effective the date of this Order.

IT IS, THEREFORE, ORDERED as follows:

1. That the Commission hereby adopts the revised rules as shown in Appendix A (redlined) and Appendix B (clean), effective the date of this Order.

2. That each electric public utility shall file the meter testing annual report and testing plan as required by revised Rule R8-13(f), beginning April 1, 2020, and these reports shall be filed in Docket No. E-100, Sub 153A.

3. That DEC shall include in each meter testing annual report required by Rule R8-13(f) details of smart meter malfunctions or problems, and data on the number of customers on Rider MRM, annually for five years, ending with the report due on April 1, 2024, unless this requirement is re-instituted by the Commission. (This filing requirement was initially established in the Commission's June 22, 2018 MRM Order.) As to the requirement for DEC to annually provide a verified statement about its smart meter data privacy procedures, the Commission will address that issue in Docket No. E-100, Sub 161.

4. That DEP shall include in each meter testing annual report required by Rule R8-13(f) details of smart meter malfunctions or problems, and the number of customers enrolled in each option of Rider MROP annually for five years, ending with the report due on April 1, 2024, unless this requirement is re-instituted by the Commission. (This filing requirement was initially established in the Commission's January 23, 2019 Order Modifying Program in Docket No. E-2, Sub 834.)

5. That the electric public utilities shall periodically provide in-person briefings to the Commission regarding the schedule, scope, and results of cyber-security audits of their AMI communication systems.

ISSUED BY ORDER OF THE COMMISSION.

This the 27th day of November, 2019.

NORTH CAROLINA UTILITIES COMMISSION

Kimberley A. Campbell

Kimberley A. Campbell, Chief Clerk

ARTICLE 3

METERS, METER TESTS, AND RECORDS

Note: Throughout this Article 3, cited standards of the American National Standards Institute (ANSI) means the most recent approved ANSI standard as amended from time to time.

Rule R8-9. LOCATION AND CONTROL OF METERS.

(a) No consumer's meter shall be installed in any location where it may be unreasonably exposed to heat, cold, dampness or other cause of damage, or in any unduly dirty or inaccessible location.

(b) ~~Meters should not be placed in coal or wood bins or on partitions forming such bins, or on any unstable supports subject to vibration.~~ Unless otherwise authorized by the Commission, each electric utility shall provide, install, and continue to own and maintain all meters necessary for the measurement of electric energy consumed by its customers.

(c) ~~Meters should be easily accessible for reading, testing, and making necessary adjustments and repairs. When several meters are placed on one meter board the distance between centers should not, where practicable, be less than 15 inches, and each "house" loop should be tagged or marked to indicate the circuit metered.~~ All meters shall be of a standard type that meets applicable industry standards for the type and application of electric utility service.

(d) Meters shall be placed on stable and unobstructed supports sufficient for the purpose of maintaining the integrity of the meter, meter base, and any other appurtenant equipment necessary for metered utility service.

(e) Meters shall be easily accessible and acceptable clearances shall be maintained on all sides of enclosures for installing, removing, reading, testing, communicating, and making necessary adjustments and repairs. Such clearances must allow for any hinged doors or panels to be opened a minimum of 90 degrees. When two or more meter enclosures are placed on one meter board, each meter enclosure shall be tagged to indicate the circuit metered.

(~~d~~f) Each customer shall provide and maintain a suitable and convenient place for the location of meters, where they will be readily accessible at any reasonable hour for the purpose of reading, testing, repairing, removing etc., and such other appliances owned by the utility and placed on the premises of the ~~consumer~~ customer shall be so placed as to be readily accessible at such times as are necessary, and the authorized agent of the utility shall have authority to visit such meters and appurtenances at such times as are necessary in the conduct of the business of the utility.

Rule R8-10. TESTING FACILITIES.

(a) Each utility furnishing metered electric service shall, unless specifically excused by the Commission, provide and have available such meter laboratory, standard meters, instruments, and facilities as may be necessary to make the tests required by these rules, together with such portable indicating electrical testing instruments, watt hour meters, and facilities of suitable type and range for testing service watt hour meters, voltmeters and other electrical equipment, used in its operations, as may be deemed necessary and satisfactory to the Commission.

(b) All portable indicating electrical testing instruments ~~such as voltmeters, ammeters and watt hour meters~~, when in regular use for testing purposes, shall be checked against suitable reference standards periodically, and with such frequency as to insure their accuracy whenever used in testing service meters of the utility.

Rule R8-11. METHOD OF DETERMINING AVERAGE ERROR OF METERS.

(a) ~~In determining the average error of a watt hour meter, the following procedure is recommended:~~ The average percent registration of a watt hour meter shall be determined using one of the following methods prescribed by the American National Standards Institute (ANSI) Standard C12.1 – Code for Electricity Metering, where “FL” means the percent registration at full load test amps and unity power factor, “LL” means the percent registration at light load test amps and unity power factor, and “PF” means the percent registration at full load test amps and 50% power factor:

(1) ~~All meters whenever possible, shall be tested at the following three loads: one tenth of the current rating of the meter, normal load and at rating.~~ Method 1: Average percent registration = (4FL + LL)/5

(2) ~~The average of these tests obtained by multiplying the results of the test at normal load by three (3), adding the results of the tests at one tenth rating and at the current rating, and dividing the total by five, shall be deemed the condition of the meter.~~ Method 2: Average percent registration = (FL + LL)/2

(3) ~~In an installation where it is impossible to obtain a load of ten percent (10%) of the rating, or one hundred percent (100%) of the rating of the meter tests shall be made at the nearest obtainable loads to ten percent (10%) and one hundred percent (100%) of the rating of the meter and the values given in the ratios as stated above.~~ Method 3: Average percent registration = registration at a single load point when this single load point represents the registration within the range.

(4) Method 4: Average percent registration = (4FL + 2LL + PF)/7

~~(b) To determine normal load, use the percentage of connected load indicated below for the class of service metered.~~

~~*Class of Service Metered*~~	~~*Percentage of Connected Load*~~
~~Residence and Apartment Lighting~~	~~40%~~
~~Elevator Service~~	~~40%~~
~~Factories (Individual Drive), Churches and Offices~~	~~45%~~
~~Factories (Shaft Drive), Theatres, Clubs, Entrances, Hallways, and General Store Lighting~~	~~60%~~
~~Restaurants, Pumps, Air Compressors, Ice Machines and Moving Picture Theatres~~	~~70%~~
~~Signs and Window Lighting and Blowers~~	~~100%~~

~~(c) When a meter is connected to an installation consisting of two or more of the above classes of load, the normal load would be the sum of the normal loads for each class.~~

Rule R8-12. METER ACCURACY.

(a) ~~Creeping. —~~ No watt hour meter ~~which~~ that registers on "no load" as defined by ANSI C12.1 (voltage circuits energized and zero current), ~~when the applied voltage is less than one hundred and ten percent (110%) of standard service voltage~~ shall be placed in service or allowed to remain in service.

(b) ~~Initial Accuracy Requirements. —~~ No watt hour meter shall be placed in service ~~which~~ that is in any way ~~mechanically~~ defective~~,~~ or ~~which~~ has incorrect constants, nor shall any watt hour meter be maintained in service ~~which~~ that does ~~is~~ not ~~adjusted to~~ meet the following performance requirements: Average percent registration not less than 98% or more than 102%.

~~Average error not over 2% plus or minus;~~
~~Error at heavy load not over 2% plus or minus;~~
~~Error at light load not over 4% plus or minus.~~

(c) ~~Adjustment after Test. — Whenever a test made by the utility or by the Commission on a service watt hour meter connected in its permanent position in place of service shows that the average error is greater than that specified above, the meter shall be adjusted to bring the average error within the specified limits.~~ All meters shall be accuracy tested by the manufacturer. Test results shall be provided to the utility and stored by the utility for the life of the meter and at least three years after the retirement of the meter.

(d) ~~Allowable Error. — A service watt hour meter having an average error of not more than 2% plus or minus, may be considered as correct, and no adjustment of charges shall be entailed by such an error.~~ Acceptance testing shall be performed on a statistically valid sample of each shipment of new meters. The statistical sampling plan used shall conform to the accepted principles of statistical sampling as set forth in ANSI Z1.4 – Sampling

Procedures and Tables for Inspection by Attributes, ANSI Z1.9 – Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming, or other generally accepted statistical methodology. If the total number of failures exceeds the level allowed under the sample plan, the entire shipment will be rejected and returned to the manufacturer or corrected on site.

(e) Whenever a test made by the utility or Commission on a service watt hour meter connected in its permanent position in place of service shows an average percent registration less than 98% or more than 102%, the meter shall be replaced.

(f) A service watt hour meter having an average percent registration not less than 98% or more than 102% may be considered as correct, and no adjustment of charges shall be entailed by such an error.

Rule R8-13. ~~PERIODIC TESTS OF METERS~~ IN-SERVICE METER TESTING.

(a) Meter Testing Required -- Each in-service watt hour billing meter shall be included in either a periodic or sampling test~~ed~~ing plan as prescribed by ANSI C12.1 – Code for Electricity Metering. Average meter registration accuracy that is less than 98% or more than 102% will be counted as a failure.~~according to the following schedule, while connected, if practical, in its permanent position in place of service:~~

~~(1) Two and three wire commutating type and mercury type meters, up to and including 50 amperes rated capacity of meter element, shall be tested at least once every 18 months.~~

~~(2) Two and three wire commutating type and mercury type meters of over 50 amperes rated capacity of meter element shall be tested at least once every 12 months.~~

~~(3) Two and three wire single phase induction type meters, up to and including 25 amperes rated capacity of meter element, shall be tested at least once every 96 months.~~

~~(4) Two and three wire single phase induction type meters of over 25 amperes rated capacity of meter element shall be tested at least every 96 months.~~

~~(5) Self contained polyphase meters, up to and including 50 kW rated capacity, shall be tested at least once every 72 months.~~

~~(6) Self contained polyphase meters of over 50 kW rated capacity shall be tested at least once every 72 months.~~

~~(7) Polyphase meters, connected through current transformers or current and potential transformers, to circuits up to and including 50 kW rated capacity, shall be tested at least once every 48 months.~~

~~(8) Polyphase meters, connected through current transformers or current and potential transformers, to circuits of over 50 kW rated capacity, shall be tested at least once every 48 months.~~

~~(9) A statistical sampling program for self contained single phase watt hour meters may be used by any utility in lieu of the periodic testing program specified under subdivisions (3) and (4) above provided the utility files with~~

~~the Commission a statistical sampling plan which is approved by the Commission and which conforms to the following criteria:~~

~~a. The plan submitted shall conform to accepted principles of statistical sampling and should be evaluated by qualified independent mathematical statisticians.~~

~~b. The plan shall include an adequate policy for testing meters on request and a consumer protection procedure for high bills due to fast meters to compensate for the fact that an individual meter may not be tested for a period longer than the present eight year schedule.~~

~~c. Meters shall be divided into homogeneous groups such as manufacturer's types and, if necessary, into homogeneous groups on the basis of location or other environmental factors which may affect the performance of the meters.~~

~~d. A sample shall be taken each year, from each homogeneous group, of a sufficient size to demonstrate with reasonable assurance the condition of the group from which the sample is drawn.~~

~~e. It is extremely important that each meter in each group be drawn with known probability, and the sample must be selected at random. (In most probability sampling systems involved in meter registration control, it is expected that every meter in the group will have an equal chance to be drawn; however, the criteria are written to allow a wider choice of probability sampling systems.) In order to accomplish random sampling, it is necessary to use a table of random numbers, or some equivalent mechanical or numerical procedure.~~

~~f. The sampling plan shall be designed to provide information on which the utility may base a program to maintain its meters in an acceptable degree of accuracy throughout their service life in accordance with the requirements of the Commission and in keeping with proper standards for good customer relations. The plan shall contain a table of mathematically calculated sample sizes and related values in accordance with g below for determining the characteristics of the homogeneous groups, accompanied by curves for determining the risk of making an incorrect decision which may be detrimental to the customer or to the utility.~~

~~g. An acceptable sampling program is one having the property that, when applied to a meter group in which the proportion of meters with registrations greater than 102% is as high as 0.03, then the probability that the group will be judged to be satisfactory (and no corrective action taken) shall be no greater than 0.05. A sample size at least 400 meters for a plan based on the attributes method is recommended. If a variable plan is used, select a minimum sample size so that the variable plan under minimum sample size will have roughly the same operating characteristics curve as the attributes plan for the minimum sample size stated above. If a group of meters~~

~~does not meet the performance criteria, then an established program of corrective action shall be followed.~~

~~h. The corrective action shall consist of an accelerated test and maintenance program to raise the accuracy performance of the group to acceptable standards or it may consist of retirement of the meters in the group from service in an accelerated rate. The accelerated test program should provide for testing at rates which vary in accordance with the calculated percentage of meters in the group outside the acceptable limits of accuracy but not less than 20% of the group tested per year. When any group of meters is so placed on an accelerated test program the meters, selected each year for test, shall be selected on the basis of the longest time since last test. Meters so tested and placed into service shall be sampled as a separate group from the remainder of the original group not tested. When the sample results of the remainder of the original group indicate that the group has come up to acceptable limits the two components of the group may be consolidated for sampling.~~

~~i. Reports shall be made to the Commission annually to indicate the number of meters in each homogeneous group in service at the beginning of each year, the number of meters making up the sample for each such group, the test results for each group and any corrective action taken.~~

(b) Statistical Sampling Plan – The statistical sampling plan provides for the division of meters into homogenous groups such as manufacturer and manufacturer type and may be further subdivided based on other factors such as age or vintage of meter. The selection process is random where each meter within each group has an equal chance of being selected. Selected meters in each group are tested for energy registration accuracy. The statistical sampling plan used shall conform to the accepted principles of statistical sampling as found in ANSI Z1.4 – Sampling Procedures and Tables for Inspection by Attributes, ANSI Z1.9 – Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming, or other statistically valid programs that have been evaluated by qualified independent mathematical statisticians.

(c) Periodic Interval Plan – Every meter included in a periodic interval plan shall be tested for energy registration accuracy at a minimum of once every sixteen years. The utility may elect to test more frequently based on factors such as complexity of the metering system, class of customer, or size of service.

(d) Corrective Action -- If testing pursuant to subsection (a) or (b) shows that a meter or group of meters does not meet the performance criteria, then an established program of corrective action shall be followed. Corrective action shall consist of one or more of the following methods listed in ANSI C12.1 section 5.0.3.4.4: a) an accelerated test program, b) splitting a group into two or more subgroups, c) a time-specific retirement program, or d) a sample-driven retirement program. The accelerated test program should provide for testing at rates that vary in accordance with the calculated percentage of meters in the

group outside the acceptable limits of accuracy but not less than 20% of the group tested per year. Meters so tested and placed into service shall be sampled as a separate group from the remainder of the original group not tested. When the sample results of the remainder of the original group indicate that the group has come up to acceptable limits the two components of the group may be consolidated for sampling.

(e) Utility to Retain Test Results -- Accuracy test results shall be stored by the utility for the life of the meter and at least three years after the retirement of the meter.

(f) Utility Reporting -- No later than April 1 of each year, a utility shall report to the Commission on its in-service meter program. For tests performed pursuant to subsection (b), the report shall indicate the number of meters in each homogeneous group in service at the beginning of each year, the number of meters making up the sample for each such group, the test results for each group, and any corrective action taken. In addition, the report shall describe the results from meters tested under a periodic interval plan pursuant to subsection (c), including the number of meters in each homogeneous group in service at the beginning of each year, the number of meters tested, the test results, and any corrective action taken. The report shall also identify any classes of meters for which the utility tests on a more frequent basis than prescribed in ANSI C12.1, and the basis for the more frequent testing. The report shall also outline the current year's testing plan.

(g) Inspections -- When metering installations are tested or inspected, instrument transformers and wiring associated with the installation shall be visually inspected for correctness of connections and evidence of damage. Nameplate or stenciled ratios shall be verified against ratios used by the utility for billing. These inspections are not required if performing them cannot be done safely.

Rule R8-14. METER TESTING AT REQUEST OF ~~CONSUMERS~~CUSTOMERS.

(a) Upon reasonable notice, when requested in writing by the ~~consumer~~ customer, each utility shall test the accuracy of the meter in use by the ~~consumer~~ customer.

(b) No deposit or payment shall be required from the ~~consumer~~ customer for a meter test, except when the ~~consumer~~ customer has requested, within the previous twelve months, that the same meter be tested, in which case the ~~consumer~~ customer shall be required by the utility to deposit with it an amount as determined by the Commission to cover the reasonable cost of such test.

(c) A schedule of deposits or fees for testing various classifications of meters shall be filed with, and approved by, the Commission.

(d) The amount so deposited with the utility shall be refunded or credited to the ~~consumer~~ customer (as a part of the settlement in the case of a disputed account) if the meter is found, when tested, to register more than two percent (2%) fast; otherwise the deposit shall be retained by the utility.

(e) The ~~consumer~~ customer may, if ~~he~~ customer so requests, be present when the utility conducts the test on ~~his~~ customer's meter, or if ~~he~~ the customer desires, may

provide (at ~~his~~ customer's expense) an expert, or other representative appointed by ~~him~~ customer, to be present at the time of the meter test.

(f) A report of the results of the meter test shall be made within a reasonable time after the completion of the test. This report shall give the name of the ~~consumer~~ customer requesting the test, the date of the request, the location of the premises where the meter is installed, the type, make, size, and serial number of the meter, the date of removal, the date tested, and the results of the test, a copy of which shall be supplied to the ~~consumer~~ customer upon request. The utility shall inform the ~~consumer~~ customer that ~~he~~ the customer has a right to request such written copy of the report of the meter test.

(g) Any meter tested pursuant to this rule that fails the following performance requirements shall be removed from service and remain out of service until it is determined to be in compliance: Average percent registration not less than 98% or more than 102%.

ARTICLE 4

OPERATION

Note: Throughout this Article 4, cited standards of the American National Standards Institute (ANSI) means the most recent approved ANSI standard as amended from time to time.

Rule R8-16. STANDARD FREQUENCY.

~~Each utility supplying alternating current shall adopt a standard frequency, the suitability of which may be determined by the Commission, and shall maintain this frequency within 2% plus or minus of standard at all times during which service is supplied; provided, however, the momentary variations of frequency of more than 5%, which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be construed as a violation of this rule.~~ [Repealed.]

Rule R8-17. STANDARD VOLTAGE.

(a) Each electric supplier shall adopt and file with the Commission standard average service voltages available from its distribution class facilities. The filing shall contain the nominal voltage, base voltage, lower limit, and upper limit. The voltage maintained at the point of delivery shall be reasonably constant and variations therein should not normally exceed the limits set forth in this rule.

(1) The standard nominal voltage adopted by the electric supplier shall be a voltage indicated by the version of ANSI Standard C84.1, Electric Power Systems and Equipment-Voltage Ratings (60 Hz), or equivalent ANSI standard as later amended, in effect at the time of adoption of nominal voltages. ~~In order to promote standardization of service voltages,~~ T~~t~~he

following standard nominal service voltages are hereby adopted by the Commission as the preferred standard nominal service voltages:

NOMINAL SYSTEM VOLTAGE<u>**</u>**		
Two-wire	Three-wire	Four-wire
Single-Phase Systems		
120*	**120/240***	
Three-Phase Systems		
		208Y/120<u>*</u>**
		240/120
	240	
		480Y/277
	480	
	600**	
	2400	
	4160	4160Y/2400
	4800	
	6900	
		8320Y/4800
		12000Y/6930
		12470Y/7200
		13200Y/7620
	~~1380~~**<u>13800</u>**	**13800Y/7970**
		20780Y/12000
	23000	22860Y/13200
		24940Y/14400
	34500	**34500Y/19920**

*see (a)(2) below

** This classification covers the range of nominal voltages from 550 to 600 volts.

<u>***A modification of this three-phase, four-wire system is available as a 120/208YV service for single-phase, three-wire, open-wye applications.</u>

<u>****Preferred system voltages are in bold-face type.</u>

(2) ~~Each electric supplier operating within the State of North Carolina under the jurisdiction of the Commission shall offer 120/240 volt, single phase service. No electric supplier shall offer 115/230 volt single phase service or other such similar variant of 120/240 volt single phase service except upon specific authorization of the Commission.~~ <u>An electric supplier may adopt different nominal voltages to serve specific customers if such action does not compromise prudent transmission and distribution system operation.</u>

(b) In order to promote harmony between the service of electric suppliers and the utilization <u>of</u> voltage requirements of presently manufactured equipment, the following service voltage variations are permitted:

(1) For service rendered for individual residential use or specifically for lighting purposes, the voltage variations shall not exceed five percent (5%) above or below the standard base voltage.

(2) For other service the voltage variations shall not exceed ten percent (10%) above or below the standard base voltage.

(c) An electric supplier may elect to deliver service at a nominal voltage ~~which~~ that is not standard on its system. The variation in the nonstandard voltage shall not exceed the limits set forth above for the type of service being rendered.

(d) Upon approval of the Commission and proper notification to its customers a utility may cease to deliver a particular voltage.

(e) Variations in voltage in excess of those specified that are caused by the following ~~addition of customer equipment without proper notification to the electric supplier, by the operation of customer's equipment, by the action of the elements, by infrequent and unavoidable fluctuations of short duration due to system operations, by conditions which are part of practical operations and are of limited extent, frequency, and duration, or by emergency operations~~ shall not be construed a violation of this rule~~.~~ :

(1) Addition of customer equipment without proper notification to the electric supplier.

(2) Operation of customer's equipment.

(3) The action of the elements.

(4) Infrequent and unavoidable fluctuations of short duration due to system operations.

(5) Conditions that are part of practical operations and are of limited extent, frequency, and duration.

(6) Emergency operations.

(f) ~~Consumers~~ Customers shall select, install, maintain and operate their electrical equipment so as to cause the least interference with the regulation of the electric supply system. Three phase motors in excess of 20 horsepower, single phase motors in excess of five horsepower and other apparatus with high starting or fluctuating currents must be installed in accordance with the supplier's filed tariffs and rules and regulations.

(g) Greater variations in voltage for service to installations ~~which~~ that permit greater variations than those required above may be allowed upon specific authorization by ~~this~~ the Commission.

Rule R8-21. INSTALLATION OR REPLACEMENT OF METERS AND CHANGES IN LOCATION OF SERVICE.

(a) A customer's request for electric utility service grants the utility permission to install any metering device that meets the requirements of Rules R8-8, -9, -11, and -12, as deemed appropriate by the utility and in compliance with Commission orders.

(b) Whenever a ~~consumer~~ customer requests the replacement of the service meter on the customer's ~~his~~ premises, such request shall be treated as a request for the test of such meter, and as such, shall fall under the provisions of Rule R8-14.

(~~b~~c) Whenever a ~~consumer~~ customer moves from the location where ~~current~~ electric service is used by ~~him~~ the customer, and thereby requires the disconnecting and/or connecting at a new location of the electric ~~supply~~ supplier, or information is required from the metering infrastructure to complete the transfer of service, and the same work has been done for ~~him~~ the customer within one year preceding, the utility may make a charge, subject to such charge having been approved by the Commission.

ARTICLE 3

METERS, METER TESTS, AND RECORDS

Note: Throughout this Article 3, cited standards of the American National Standards Institute (ANSI) means the most recent approved ANSI standard as amended from time to time.

Rule R8-9. LOCATION AND CONTROL OF METERS.

(a) No consumer's meter shall be installed in any location where it may be unreasonably exposed to heat, cold, dampness or other cause of damage, or in any unduly dirty or inaccessible location.

(b) Unless otherwise authorized by the Commission, each electric utility shall provide, install, and continue to own and maintain all meters necessary for the measurement of electric energy consumed by its customers.

(c) All meters shall be of a standard type that meets applicable industry standards for the type and application of electric utility service.

(d) Meters shall be placed on stable and unobstructed supports sufficient for the purpose of maintaining the integrity of the meter, meter base, and any other appurtenant equipment necessary for metered utility service.

(e) Meters shall be easily accessible and acceptable clearances shall be maintained on all sides of enclosures for installing, removing, reading, testing, communicating, and making necessary adjustments and repairs. Such clearances must allow for any hinged doors or panels to be opened a minimum of 90 degrees. When two or more meter enclosures are placed on one meter board, each meter enclosure shall be tagged to indicate the circuit metered.

(f) Each customer shall provide and maintain a suitable and convenient place for the location of meters, where they will be readily accessible at any reasonable hour for the purpose of reading, testing, repairing, removing etc., and such other appliances owned by the utility and placed on the premises of the customer shall be so placed as to be readily accessible at such times as are necessary, and the authorized agent of the utility shall have authority to visit such meters and appurtenances at such times as are necessary in the conduct of the business of the utility.

Rule R8-10. TESTING FACILITIES.

(a) Each utility furnishing metered electric service shall, unless specifically excused by the Commission, provide and have available such meter laboratory, standard meters, instruments, and facilities as may be necessary to make the tests required by these rules, together with such portable indicating electrical testing instruments, watt hour meters, and facilities of suitable type and range for testing service watt hour meters, voltmeters and other electrical equipment, used in its operations, as may be deemed necessary and satisfactory to the Commission.

(b) All portable indicating electrical testing instruments, when in regular use for testing purposes, shall be checked against suitable reference standards periodically, and with such frequency as to insure their accuracy whenever used in testing service meters of the utility.

Rule R8-11. METHOD OF DETERMINING AVERAGE ERROR OF METERS.

(a) The average percent registration of a watt hour meter shall be determined using one of the following methods prescribed by the American National Standards Institute (ANSI) Standard C12.1 – Code for Electricity Metering, where “FL” means the percent registration at full load test amps and unity power factor, “LL” means the percent registration at light load test amps and unity power factor, and “PF” means the percent registration at full load test amps and 50% power factor:

(1) Method 1: Average percent registration = (4FL + LL)/5

(2) Method 2: Average percent registration = (FL + LL)/2

(3) Method 3: Average percent registration = registration at a single load point when this single load point represents the registration within the range

(4) Method 4: Average percent registration = (4FL + 2LL + PF)/7

Rule R8-12. METER ACCURACY.

(a) No watt hour meter that registers on "no load" as defined by ANSI C12.1 (voltage circuits energized and zero current), shall be placed in service or allowed to remain in service.

(b) No watt hour meter shall be placed in service that is in any way defective or has incorrect constants, nor shall any watt hour meter be maintained in service that does not meet the following performance requirements: Average percent registration not less than 98% or more than 102%.

(c) All meters shall be accuracy tested by the manufacturer. Test results shall be provided to the utility and stored by the utility for the life of the meter and at least three years after the retirement of the meter.

(d) Acceptance testing shall be performed on a statistically valid sample of each shipment of new meters. The statistical sampling plan used shall conform to the accepted principles of statistical sampling as set forth in ANSI Z1.4 – Sampling Procedures and Tables for Inspection by Attributes, ANSI Z1.9 – Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming, or other generally accepted statistical methodology. If the total number of failures exceeds the level allowed under the sample plan, the entire shipment will be rejected and returned to the manufacturer or corrected on site.

(e) Whenever a test made by the utility or Commission on a service watt hour meter connected in its permanent position in place of service shows an average percent registration less than 98% or more than 102%, the meter shall be replaced.

(f) A service watt hour meter having an average percent registration not less than 98% or more than 102% may be considered as correct, and no adjustment of charges shall be entailed by such an error.

Rule R8-13. IN-SERVICE METER TESTING.

(a) Meter Testing Required -- Each in-service watt hour billing meter shall be included in either a periodic or sampling testing plan as prescribed by ANSI C12.1 – Code for Electricity Metering. Average meter registration accuracy that is less than 98% or more than 102% will be counted as a failure.

(b) Statistical Sampling Plan – The statistical sampling plan provides for the division of meters into homogenous groups such as manufacturer and manufacturer type and may be further subdivided based on other factors such as age or vintage of meter. The selection process is random where each meter within each group has an equal chance of being selected. Selected meters in each group are tested for energy registration accuracy. The statistical sampling plan used shall conform to the accepted principles of statistical sampling as found in ANSI Z1.4 – Sampling Procedures and Tables for Inspection by Attributes, ANSI Z1.9 – Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming, or other statistically valid programs that have been evaluated by qualified independent mathematical statisticians.

(c) Periodic Interval Plan – Every meter included in a periodic interval plan shall be tested for energy registration accuracy at a minimum of once every sixteen years. The utility may elect to test more frequently based on factors such as complexity of the metering system, class of customer, or size of service.

(d) Corrective Action -- If testing pursuant to subsection (a) or (b) shows that a meter or group of meters does not meet the performance criteria, then an established program of corrective action shall be followed. Corrective action shall consist of one or more of the following methods listed in ANSI C12.1 section 5.0.3.4.4: a) an accelerated test program, b) splitting a group into two or more subgroups, c) a time-specific retirement program, or d) a sample-driven retirement program. The accelerated test program should provide for testing at rates that vary in accordance with the calculated percentage of meters in the group outside the acceptable limits of accuracy but not less than 20% of the group tested per year. Meters so tested and placed into service shall be sampled as a separate group from the remainder of the original group not tested. When the sample results of the remainder of the original group indicate that the group has come up to acceptable limits the two components of the group may be consolidated for sampling.

(e) Utility to Retain Test Results -- Accuracy test results shall be stored by the utility for the life of the meter and at least three years after the retirement of the meter.

(f) Utility Reporting -- No later than April 1 of each year, a utility shall report to the Commission on its in-service meter program. For tests performed pursuant to subsection (b), the report shall indicate the number of meters in each homogeneous group in service at the beginning of each year, the number of meters making up the sample for each such group, the test results for each group, and any corrective action taken. In addition, the report shall describe the results from meters tested under a periodic interval plan pursuant to subsection (c), including the number of meters in each homogeneous group in service at the beginning of each year, the number of meters tested, the test results, and any corrective action taken. The report shall also identify any classes of meters for which the utility tests on a more frequent basis than prescribed in ANSI C12.1, and the basis for the more frequent testing. The report shall also outline the current year's testing plan.

(g) Inspections -- When metering installations are tested or inspected, instrument transformers and wiring associated with the installation shall be visually inspected for correctness of connections and evidence of damage. Nameplate or stenciled ratios shall be verified against ratios used by the utility for billing. These inspections are not required if performing them cannot be done safely.

Rule R8-14. METER TESTING AT REQUEST OF CUSTOMERS.

(a) Upon reasonable notice, when requested in writing by the customer, each utility shall test the accuracy of the meter in use by the customer.

(b) No deposit or payment shall be required from the customer for a meter test, except when the customer has requested, within the previous twelve months, that the same meter be tested, in which case the customer shall be required by the utility to deposit with it an amount as determined by the Commission to cover the reasonable cost of such test.

(c) A schedule of deposits or fees for testing various classifications of meters shall be filed with, and approved by, the Commission.

(d) The amount so deposited with the utility shall be refunded or credited to the customer (as a part of the settlement in the case of a disputed account) if the meter is found, when tested, to register more than two percent (2%) fast; otherwise the deposit shall be retained by the utility.

(e) The customer may, if customer so requests, be present when the utility conducts the test on customer's meter, or if the customer desires, may provide (at customer's expense) an expert, or other representative appointed by customer, to be present at the time of the meter test.

(f) A report of the results of the meter test shall be made within a reasonable time after the completion of the test. This report shall give the name of the customer requesting the test, the date of the request, the location of the premises where the meter is installed, the type, make, size, and serial number of the meter, the date of removal, the date tested, and the results of the test, a copy of which shall be supplied to the customer upon request. The utility shall inform the customer that the customer has a right to request such written copy of the report of the meter test.

(g) Any meter tested pursuant to this rule that fails the following performance requirements shall be removed from service and remain out of service until it is determined to be in compliance: Average percent registration not less than 98% or more than 102%.

ARTICLE 4

OPERATION

Note: Throughout this Article 4, cited standards of the American National Standards Institute (ANSI) means the most recent approved ANSI standard as amended from time to time.

Rule R8-16. STANDARD FREQUENCY.

[Repealed.]

Rule R8-17. STANDARD VOLTAGE.

(a) Each electric supplier shall adopt and file with the Commission standard average service voltages available from its distribution class facilities. The filing shall contain the nominal voltage, base voltage, lower limit, and upper limit. The voltage maintained at the point of delivery shall be reasonably constant and variations therein should not normally exceed the limits set forth in this rule.

(1) The standard nominal voltage adopted by the electric supplier shall be a voltage indicated by the version of ANSI Standard C84.1, Electric Power Systems and Equipment-Voltage Ratings (60 Hz), or equivalent ANSI

standard as later amended, in effect at the time of adoption of nominal voltages. The following standard nominal service voltages are hereby adopted by the Commission as the preferred standard nominal service voltages:

NOMINAL SYSTEM VOLTAGE****		
Two-wire	Three-wire	Four-wire
Single-Phase Systems		
120*	**120/240***	
Three-Phase Systems		
		208Y/120***
		240/120
	240	
		480Y/277
	480	
	600**	
	2400	
	4160	4160Y/2400
	4800	
	6900	
		8320Y/4800
		12000Y/6930
		12470Y/7200
		13200Y/7620
	13800	**13800Y/7970**
		20780Y/12000
	23000	22860Y/13200
		24940Y/14400
	34500	**34500Y/19920**

*see (a)(2) below

** This classification covers the range of nominal voltages from 550 to 600 volts.

***A modification of this three-phase, four-wire system is available as a 120/208YV service for single-phase, three-wire, open-wye applications.

****Preferred system voltages are in bold-face type.

(2) An electric supplier may adopt different nominal voltages to serve specific customers if such action does not compromise prudent transmission and distribution system operation.

(b) In order to promote harmony between the service of electric suppliers and the utilization of voltage requirements of presently manufactured equipment, the following service voltage variations are permitted:

(1) For service rendered for individual residential use or specifically for lighting purposes, the voltage variations shall not exceed five percent (5%) above or below the standard base voltage.

(2) For other service the voltage variations shall not exceed ten percent (10%) above or below the standard base voltage.

(c) An electric supplier may elect to deliver service at a nominal voltage that is not standard on its system. The variation in the nonstandard voltage shall not exceed the limits set forth above for the type of service being rendered.

(d) Upon approval of the Commission and proper notification to its customers a utility may cease to deliver a particular voltage.

(e) Variations in voltage in excess of those specified that are caused by the following shall not be construed a violation of this rule:

(1) Addition of customer equipment without proper notification to the electric supplier.

(2) Operation of customer’s equipment.

(3) The action of the elements.

(4) Infrequent and unavoidable fluctuations of short duration due to system operations.

(5) Conditions that are part of practical operations and are of limited extent, frequency, and duration.

(6) Emergency operations.

(f) Customers shall select, install, maintain and operate their electrical equipment so as to cause the least interference with the regulation of the electric supply system. Three phase motors in excess of 20 horsepower, single phase motors in excess of five horsepower and other apparatus with high starting or fluctuating currents must be installed in accordance with the supplier's filed tariffs and rules and regulations.

(g) Greater variations in voltage for service to installations that permit greater variations than those required above may be allowed upon specific authorization by the Commission.

Rule R8-21. INSTALLATION OR REPLACEMENT OF METERS AND CHANGES IN LOCATION OF SERVICE.

(a) A customer's request for electric utility service grants the utility permission to install any metering device that meets the requirements of Rules R8-8, -9, -11, and -12, as deemed appropriate by the utility and in compliance with Commission orders.

(b) Whenever a customer requests the replacement of the service meter on the customer's premises, such request shall be treated as a request for the test of such meter, and as such, shall fall under the provisions of Rule R8-14.

(c) Whenever a customer moves from the location where electric service is used by the customer, and thereby requires the disconnecting and/or connecting at a new location of the electric supplier, or information is required from the metering infrastructure to complete the transfer of service, and the same work has been done for the customer within one year preceding, the utility may make a charge, subject to such charge having been approved by the Commission.