

# POLICY NO. 440.00

## POWER QUALITY

### POLICY \_\_\_\_\_

To identify and address possible member-caused system voltage disturbances and/or current and voltage waveform distortions that could have an adverse effect on any member served by Northwestern Rural Electric Cooperative (the Cooperative) or on the Cooperative's distribution system facilities; to impose certain restrictions on members with equipment that can cause voltage disturbances and/or waveform distortions that are above allowable limits. And, to impose limits on the member power factor, which may affect the Cooperative's primary distribution system and other members.

This policy specifically addresses issues related to voltage disturbances (flicker or flicker events), to current and voltage waveform distortions (harmonics), and to power factor. The member shall not use the electric service provided by the Cooperative in any way that causes a safety hazard, damages the Cooperative's facilities, disrupts the operation of the electric distribution system, or disturbs/distorts electric service to other members. The member shall only install electrical equipment that complies with IEEE Standard 519, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*. Compliance with IEEE 519 can also reduce operating issues and extend the life of the member's equipment.

The electrical equipment must not be used in such a manner that would cause the following:

1. Detrimental voltage disturbances as described in the Voltage Disturbance - Flicker section below.
2. Detrimental voltage or current waveforms as described in the Waveform Distortion - Harmonics section below.

If any member is found to have equipment that exceeds allowable disturbance and/or distortion limits, it will be the member's responsibility to modify their use of the Cooperative's electric service to comply with this policy or pay the Cooperative to modify their electric system to accommodate the member's use of the electric service. Failure to comply with this Policy may result in discontinuance of the electric service to the member.

This Policy also states that it is the member's responsibility to provide protection from low voltage or loss of single-phase voltage as described in the Equipment Protection section below.

### RESPONSIBILITY \_\_\_\_\_

President & CEO and COO

# PROCEDURE \_\_\_\_\_

## Voltage Disturbance – Flicker

1. The member's use of certain electrical equipment can result in steady state voltage disturbances on the Cooperative's electric distribution system that can affect other Cooperative members. Voltage disturbances are characterized as a sudden variation of the system voltage. A sudden rapid voltage decrease immediately followed by a rapid voltage increase is typically referred to as a voltage "flicker." Examples of equipment that can cause a voltage flicker are:
  - A. The starting of motors:
    - Large single-phase motors
    - Large single-phase to three-phase rotary converters
    - Large three-phase motors
  - B. The operation of motors where stall/locked rotor or near stall/locked rotor conditions can frequently occur:
    - Sawmills
    - Car crushers
    - Rock crushers
    - Irrigation pump motors
    - At equipment where the load varies suddenly and by a significant amount
2. The Cooperative imposes certain restrictions on members with equipment that can cause a voltage disturbance that exceeds the allowable thresholds stated herein. Members are required to mitigate the impact of unacceptable voltage disturbances so that other members on the Cooperative's system are not subjected to unacceptable voltage flicker events. The member is responsible for installing the appropriate equipment so that the equipment shall not result in a voltage flicker greater than what is indicated in IEEE 519, Section 10.5, Flicker. The member is also responsible for correcting voltage flicker when the IEEE 519 values are exceeded and when the source of the voltage flicker has been traced back to the member's equipment. As a general guide, a voltage flicker greater than 3% on the primary distribution system closest to the Point of Common Coupling (PCC) is not allowed. The time of day and number of occurrences does influence the maximum flicker allowed.
3. To facilitate this policy, the installation of motors, phase converters, and other devices with an inrush starting current that exceeds the following table will not be allowed without prior written approval by the Cooperative.

<b>Maximum Allowed Starting Inrush or Stall/Locked Rotor Currents</b>			
<b>Service Voltage</b>	<b>Maximum Inrush Amps</b>	<b>Corresponding kVA</b>	<b>Typical Motor Size and NEMA Letter Code <sup>1</sup></b>
Single-phase 120 volt	500	60	7.5 HP, NEMA Code G
Single-phase 240 volt	250	60	7.5 HP, NEMA Code G
Three-phase 120/208 volt	667	240	40 HP, NEMA Code F
Three-phase 277/480 volt	290	240	40 HP, NEMA Code F

<sup>1</sup> Different motor sizes with different NEMA kVA/HP letter codes will be allowed as long as the Maximum Inrush Amps are not exceeded. Note that the NEMA kVA/HP Codes range from A to V with A having the lowest starting kVA/HP value.

4. For motors or other equipment that exceed the above maximum inrush amp limits, it is the member's responsibility to consult with the Cooperative on the acceptability of a particular motor or other equipment at a particular location. The Cooperative will determine acceptability based on inrush starting characteristics including the anticipated frequency of start(s). To evaluate the acceptability of the member's electrical equipment and motor starting characteristics, the Cooperative will apply IEEE and/or ANSI Standards. The Cooperative will provide any further specific restrictions in the Electric Service Agreement between the member and the Cooperative.

#### **Waveform Distortion – Harmonics**

1. The member's use of certain equipment can distort the 60 Hertz current and voltage waveforms which can also affect other Cooperative members, the Cooperative's facilities, or nearby communication facilities. These waveform distortions are referred to as "harmonics." Examples of non-linear electrical equipment that can cause current and voltage waveform distortions are:
  - Single-phase to three-phase electronic power converters
  - Variable Frequency Drives (also referred to as Variable Speed Drives or Adjustable Speed Drives)
  - Arc furnaces
  - Induction furnaces
  - Arc welders
  - Computer Numerically Controlled (CNC) machines
  - Any non-linear load (loads that draw non-sinusoidal current)
  - Computers
  - Inverters associated with solar farms or wind farms

2. The Cooperative imposes certain restrictions on members with equipment that can cause current and voltage waveform distortion. Members are required to mitigate the impact of the waveform distortion so that other members on the Cooperative's system are not subjected to unacceptable electric service and so that the Cooperative's facilities are not damaged or disrupted. The member is responsible for installing the appropriate equipment so that at the Point of Common Coupling (PCC) between the member and the Cooperative, the Total Demand Distortion (TDD) for current does not exceed the values provided in IEEE 519, Table 10-3, Current Distortion Limits for General Distribution Systems. The member is also responsible for correcting current harmonic distortion when the IEEE 519 current harmonic thresholds are exceeded, and the source of the distortion has been traced back to the member's equipment.
3. The current TDD limit is based on the member's peak kVA demand (linear and non-linear combined) at the PCC and the short circuit characteristics of the Cooperative's supply system. As a general guide, a current harmonic TDD that exceeds 5% is not allowed at the PCC without prior written approval by the Cooperative. Harmonic currents that exceed the TDD limit at the PCC may be allowed depending upon the size of the member's electrical load with respect to the characteristics of the Cooperative's supply system as illustrated in IEEE 519, Table 10-3. The TDD threshold limits that will be allowed are indicated in the Voltage Disturbance and Waveform Distortion Agreement between the member and the Cooperative.

### **Equipment Protection**

1. The Cooperative does not provide protection for equipment that can be damaged by low or loss of voltage on one phase (commonly referred to as single-phasing). To ensure that all such equipment will be disconnected from the power supply in case of abnormal steady state voltage conditions, the member is to provide its own loss-of-voltage protection on three-phase motors. This loss-of-voltage protection shall not necessarily prevent the automatic reconnection of the motor to the power supply upon return of normal voltage.

### **Power Factor**

1. The member agrees to maintain unity power factor as nearly as practicable. The Cooperative shall have the right to measure such power factor at any time. Should any such measurement indicate that the member's power factor is less than 98% leading or lagging, the member shall upon 60 days written notice correct such power factor to within  $\pm 98\%$ . If power factor is not corrected in a timely manner, the Cooperative shall have the right to increase the member's billing demand or billed usage in proportion to the measured deviation from  $\pm 98\%$ , per the Cooperative's Electric Service Agreements.

## **Distributed Energy Resources**

1. Requirements for the operating parameters of member-owned distributed energy resources (DER) relating to power quality are based on the Cooperative's technical requirements for interconnected facilities, the Cooperative's interconnection agreement(s), any specific studies performed and the resulting recommendations, and relevant industry standards including IEEE Standard 1547 IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces, IEEE 519, and others. For DER facilities interconnected without an engineering study, if power quality issues are observed, the Cooperative may require an engineering study to be performed at the member's expense.

## **REFERENCE \_\_\_\_\_**

Power Quality Agreement