

## New Mexico Cooperative Rule 568 TIIR Rules and Regulations

### 1. Introduction

This is the New Mexico Cooperative Technical Interconnection and Interoperability Requirement (TIIR) document for the state of New Mexico for compliance with IEEE Std 1547-2018. This TIIR document applies to Distribution Energy Resources (DER) applications with a nameplate rating of up to and including 10 MW connecting to a Cooperative's electric system.

This document is governed by the New Mexico Public Utilities Commission (Commission) and it must be posted in a public facing manner. The Commission set this requirement on February 14, 2023, and is part of the 17.9.568.11 NMAC (Rule 568) requirement. As updates are made to this document, the Cooperative will provide an informational filing with the Commission and an informational notice with the webpage uplink.

This is not a stand-alone document, please refer to 17.9.568.10 NMAC to review the standards and codes to install, operate, and maintain the DER and interconnection equipment in a safe manner.

### 2. Performance Categories

Normal performance categories are broken down into two groups. These categories specify reactive power capability and voltage regulation performance requirements. Rule 568 classifies that Category A requirements must be met by rotating generating facilities and Category B requirements must be met by inverter based generating facilities.

Abnormal performance categories have Category I and III requirements. Category A generating facilities must meet category I ride through requirements and category B must meet category III ride through requirements.

**Table 1: Normal and Abnormal Performance Categories**

Generating Type	Normal Performance	Abnormal Performance
Rotating Generation	Category A	Category I
Inverter-based Generation	Category B	Category III

Cooperative TIIR

### **3. Reactive Power Capability and Volage/Power Control Performance**

Normal operations for Category A (rotating machines) and Category B (inverter-based) will be discussed in Section 4. Abnormal operations of Category I (rotating generation facilities) and Category III (inverter-based) will be discussed in Section 5. The following criteria is needed when DER causes fluctuating voltages beyond the acceptable ANSI C84.1 Range A levels. The settings follow IEEE 1547-2018 guidelines.

### **4. Normal Operations Category A and Category B Requirements**

#### **4.1 Reactive Power Capability of the DER**

The Cooperative requires that the DER have reactive power capability available and compliant with IEEE 1547-2018 Section 5.2 for the applicable performance category for the specific DER type. This performance is shown in Figure H.4 of IEEE 1547-2018.

#### **4.2 Constant Power Factor**

This mode shall be disabled unless otherwise specified by the Cooperative. Should this mode be needed, the Cooperative shall specify the target power factor. It shall not require reactive power exceeding the reactive capability requirements.

#### **4.3 Voltage-Reactive Power Control**

This mode shall be enabled unless otherwise specified by the Cooperative in Interconnection Agreement. Table 2 shows the default settings for Category A and Category B. These are default settings for Voltage-Reactive Power Control from IEEE 1547-2018.  $V_{ref}$  shall be fixed and this means that it would equal  $V_n$ , or nominal voltage.

**Table 2: Voltage-Reactive Power Control Default Settings**

Voltage -Reactive Power Parameters	Default Settings	
	Category A Rotating Generation Facilities	Category B Inverter-Based
$V_{ref}$	$V_n^*$	$V_n^*$
$V_1$	$0.9 V_n$	$V_{ref} - 0.08 V_n$
$V_2$	$V_n$	$V_{ref} - 0.02 V_n$
$V_3$	$V_n$	$V_{ref} + 0.02 V_n$
$V_4$	$1.1 V_n$	$V_{ref} + 0.08 V_n$
$Q_1^{**}$	25% of nameplate apparent power rating, injection	44% of nameplate apparent power rating, injection
$Q_2$	0	0
$Q_3$	0	0
$Q_4$	25% of nameplate apparent power rating, absorption	44% of nameplate apparent power rating, absorption
Open Loop Response Time	10 seconds	5 seconds

\* -  $V_n$  is assumed to be set at DER nominal operating voltage

\*\* - The DER reactive power capability may be reduced at lower voltage

#### 4.4 Voltage-Active Power Control (For Category B, Inverter Based only)

The Cooperative requires the settings for Voltage-Active Power control to be enabled unless otherwise specified in the Interconnection Agreement. IEEE 1547-2018 default setting is to disable this mode. The DER equipment may require settings change to enable this feature. Table 3 lists the required settings for this mode unless alternatives are specified by the Cooperative.

**Table 3: Voltage-Active Power Control Default Setting**

<b>Voltage-Active Power Parameters</b>	<b>Default Setting</b>
V <sub>1</sub>	1.06 V <sub>n</sub>
P <sub>1</sub>	P <sub>rated</sub>
V <sub>2</sub>	1.10 V <sub>n</sub>
P <sub>2</sub> (applicable to DER that can only generate active power)	The lessor of 0.2 P <sub>rated</sub> or P <sub>min</sub> *
P' <sub>2</sub> (applicable to energy storage)	0**
Open Loop Response Time	10 seconds

\* - P<sub>min</sub> is the minimum active power output in per-unit of the DER rating

\*\* - P'<sub>rated</sub> is the maximum amount of active power that can be absorbed by the DER.

Energy Storage System operating in the negative real power half plane, through charging, shall follow this curve if available energy storage capacity permits this operation.

#### 4.5 Active-Reactive Power Control

The Cooperative requires the settings for Active Power-Reactive Power control to be disabled.

#### 4.6 Constant-Reactive Power Control

The Cooperative requires the settings for Constant Reactive Power control to be disabled.

### 5. Abnormal Conditions Performance for Category I and Category III

The Cooperative, Transmission Power Supplier, or Bulk Power System may have abnormal conditions on the system occur for which the DER shall appropriately respond. The Cooperative requires the settings for Voltage Disturbance Ride-Through and Frequency Disturbance Ride-Through to be enabled.

Category I performance requirements of IEEE 1547-2018 for abnormal conditions must be met by rotating generating facilities DER. Abnormal voltages are detailed in Tables 11 and 14 and Figures H.7 to H.9 of IEEE 1547-2018. Abnormal frequencies are detailed in Tables 18 and 19 and Figure H.10 of IEEE 1547-2018.

Category III performance requirements of IEEE 1547-2018 for abnormal conditions must be met by inverter-based DER. Abnormal voltages are detailed in Tables 13 and 16 and Figures H.7 to

## Cooperative TIIR

H.9 of IEEE 1547-2018. Abnormal frequencies are detailed in Tables 18 and 19 and Figure H.10 of IEEE 1547-2018.

The voltage and frequency ride through requirements specified in this section do not apply and the DER may cease to energize the Cooperative and trip without limitations if the exceptions apply per IEEE 1547-2018 Section 6.4.2.1 and 6.5.3.2.

## 5.1 Abnormal Voltages

### 5.1.1 Category I (Rotating Machine DER)

This type of DER shall trip for the voltage conditions in accordance with IEEE 1547-2018 Table 11 default settings for Category I, shown in Table 4.

**Table 4: Rotating Machine DER Abnormal Voltage Response**

Shall Trip - Category I (Rotating Machine DER)		
Shall Trip Function	Default Setting	
	Clearing Time (sec)	Voltage (per-unit of Nominal)
UV2	0.16	0.45
UV1	2.00	0.70
OV1	2.00	1.10
OV2	0.16	1.20

The DER shall ride-through consecutive temporary voltage disturbances in accordance with IEEE 1547-2018 Section 6.4.2.5 requirements for Category I DER.

### 5.1.2 Category III (Inverter-Based DER)

This type of DER shall trip for the voltage conditions in accordance with Table 5.

**Table 5: Inverter-Based DER Abnormal Voltage Response**

Shall Trip - Category III ( Inverter-Based DER)		
Shall Trip Function	Default Setting	
	Clearing Time (sec)	Voltage (per-unit of Nominal)
UV2	2.00	0.50
UV1	21.00	0.88
OV1	13.00	1.10
OV2	0.16	1.20

The DER shall ride-through consecutive temporary voltage disturbances in accordance with IEEE 1547-2018 Section 6.4.2.5 requirements for Category III DER.

## 5.2 Abnormal Frequency

### 5.2.1 Category I (Rotating Machine DER)

This type of DER shall trip for the frequency conditions in accordance with IEEE 1547-2018 Table 18 default settings for Category I, shown in Table 6.

**Table 6: Abnormal Frequency Response Category I (Rotating Machine DER)**

Shall Trip - Category I (Rotating Machine DER)		
Shall Trip Function	Default Setting	
	Clearing Time (sec)	Frequency (Hz)
OF2	0.16	62.0
OF1	300.00	61.2
UF1	300.00*	58.5
UF2	0.16	56.5

\* - The Cooperative may need to adjust the time to coordinate with typical regional under frequency load shedding programs and expected frequency restoration time

All rotating machine based DER shall comply with the rate of change of frequency ride-through performance requirements per IEEE 1547-2018 Section 6.5.2.5. All rotating machine based DER shall comply with the voltage phase angle changes ride-through requirements per IEEE 1547-2018 Section 6.5.2.6. Rotating machine based DER **may** operate with a frequency droop during both low-frequency conditions and **shall** operate with a frequency droop during high-frequency conditions per IEEE 1547-2018 Table 22.

### 5.2.2 Category III (Inverter-Based DER)

This type of DER shall trip for the frequency conditions in accordance with IEEE 1547-2018 Table 18 default settings for Category III, shown in Table 7.

**Table 7: Abnormal Frequency Response Category III (Inverter-Based DER)**

Shall Trip - Category III ( Inverter-Based DER)		
Shall Trip Function	Default Setting	
	Clearing Time (sec)	Frequency (Hz)
OF2	0.16	62.0
OF1	300.00	61.2
UF1	300.00*	58.5
UF2	0.16	56.5

\* - The Cooperative may need to adjust the time to coordinate with typical regional under frequency load shedding programs and expected frequency restoration time

All inverter-based DER shall comply with the rate of change of frequency ride-through performance requirements per IEEE 1547-2018 Section 6.5.2.5. All inverter-based DER shall comply with the voltage phase angle changes ride-through requirements per IEEE 1547-2018 Section 6.5.2.6. Inverter-based DER shall operate with a frequency droop during both low-and high frequency conditions per IEEE 1547-2018 Table 22. Inverter-based DER shall comply with the frequency droop operating parameters per IEEE 1547-2018 Table 24 default settings, as shown in Table 8.

**Table 8: Frequency Droop Operating Parameters for Category III (Inverter-Based DER)**

Parameter	Default Setting
$db_{OF}$ , $db_{UF}$ (Hz)	0.036
$k_{OF}$ , $k_{UF}$	0.05
$T_{response}$ (sec)	5

### 5.3 Dynamic Voltage Support

Dynamic Voltage Support shall be disabled.

### 5.4 Communication Protocols and Ports Requirements

The Cooperative requires the following communications protocols to be in place. Section 10 of IEEE 5147-2018 has the following as applicable to communications interoperability functions.

- A DER shall have provisions for a local DER interface capable of communicating to support information exchange requirements specified in the IEEE 1547-2018 standard for all applicable functions that are supported by the DER.

## Cooperative TIIR

- The Cooperative operator and DER operator, under mutual agreement, may have additional communication capabilities added.
- The decision to use the local DER communication interface or to deploy a communication system shall be determined by the Cooperative operator.
- Emergency and standby DER are exempt as specified from the interoperability requirements specified in IEEE 1547-2018 standard.

The DER shall support at least one of the following protocols specified in Table 9. The protocol to be utilized may be allowed under mutual consent between the Cooperative operator and DER operator.

**Table 9: List of Eligible Communication Protocols**

Protocol	Transport	Physical Layer
IEEE STD 1815 (DNP3)	TCP/IP	Ethernet
SunSpec Modbus	TCP/IP	Ethernet
SunSpec Modbus	N/A	RS-485



## 6. Abnormal Conditions Performance for Category I and Category III

### 6.1 Enter and Return to Service Parameters

The Cooperative requires the settings for Enter Service and Enter Service Ramp Rate to be enabled. The DER shall delay entry into service by an intentional minimum delay of 300 seconds. The Cooperative's steady state voltage and frequency settings for entering and returning to service are shown below in Table 10, these are the same default settings as shown in Table 4 of IEEE 1547-2018.

**Table 10: Enter and Return of Service Criteria**

<b>DER Enter and Return of Service Criteria</b>		
Voltage Within Range	Minimum Value	$\geq 0.917$ p.u.
	Maximum Value	$\leq 1.05$ p.u.
Frequency Within Range	Minimum Value	$\geq 59.5$ Hz
	Maximum Value	$\leq 60.1$ Hz

The DER shall parallel and synchronize with the Cooperative in accordance with IEEE 1547-2018 Section 4.10.4

### 6.2 Ramp Rates

Once the DER has met the requirements in 6.1, the DER shall ramp the active power output with a linear ramp over 300 seconds. However, as an exception to the ramp rate, DER systems with less than 500 kVA may randomize the enter service time of each DER unit after the minimum delay.