ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

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October 1, 2025

***VIA ELECTRONIC FILING***

Utah Public Service Commission
Heber M. Wells Building, 4th Floor
160 East 300 South
Salt Lake City, UT 84114

Attention: Gary Widerburg
Commission Administration

RE: **Docket No. 25-035-54**
Status Report of Rocky Mountain Power's Electrical Power Delivery Quality Plan.

In accordance with Administrative Rule R746-316-5, Rocky Mountain Power hereby submits this Status Report of its Electrical Power Delivery Quality Plan ("Report"). The Report attached herein contains a status update on the Company's approved Electrical Power Delivery Quality Plan as required by Utah Code §54-25 that was approved by the Public Service Commission of Utah in Docket No. 24-035-16. The reporting period is January through December 2024.

Informal inquiries may be made to Max Backlund at max.backlund@pacificorp.com or (801) 220-3121.

Sincerely,

Jana Saba
Director, Regulation and Regulatory Operations

Enclosures

## CERTIFICATE OF SERVICE

Docket Nos. 25-035-54, 24-035-16, 22-035-34

I hereby certify that on October 1, 2025, a true and correct copy of the foregoing was served by electronic mail to the following:

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ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

# UTAH
# ELECTICAL POWER QUALITY DELIVERY
# REPORT

**January 1, 2024 – December 31, 2024**

# 1 Contents

## 2 Executive Summary

Rocky Mountain Power's Electrical Power Delivery Quality Plan was created in response to administrative rule R746-316-1 which establishes requirements pertaining to the submission, review, and implementation of the Electrical Power Delivery Quality Plan pursuant to Sections 54-25-101, 54-25-102, and 54-25-201 of the Utah code. Sections 54-25-101, 54-25-102, and 54-25-201 of the Utah code are predicated on House Bill 389. This report documents implementation of the plan and presents measured power-quality performance at monitored transmission locations.

Measured quantities for each power quality category were recorded from January 01, 2024, to December 31, 2024, and summarized in this report. The analysis establishes compliance or non-compliance of monitored transmission substations against Company standards based on American National Standards Institute (ANSI) and Institute of Electrical and Electronics Engineers (IEEE). The report identifies sites with deviations to Company standards and documents initial remediation for the issues.

Most monitored transmission substations met Rocky Mountain Power's ANSI/IEEE-based power quality standards, with the majority of sites recording steady-state voltage and imbalance within accepted ranges. Monitoring captured 478 unique sag/swell/ride-through events during 2024 and identified seven locations with persistent voltage harmonic (VTHD) issues (notably Emmery, San Juan, McCracken, Plymouth, Pinto, Red Mesa, and Syracuse) requiring customer mitigation. A small number of sites showed sustained noncompliance for specific metrics such as weekly VTHD, flicker, or percent-time-in-range and are addressed through targeted operational adjustments, customer remediation plans, and follow-up monitoring.

# 3 Equipment for Assessing Power Quality

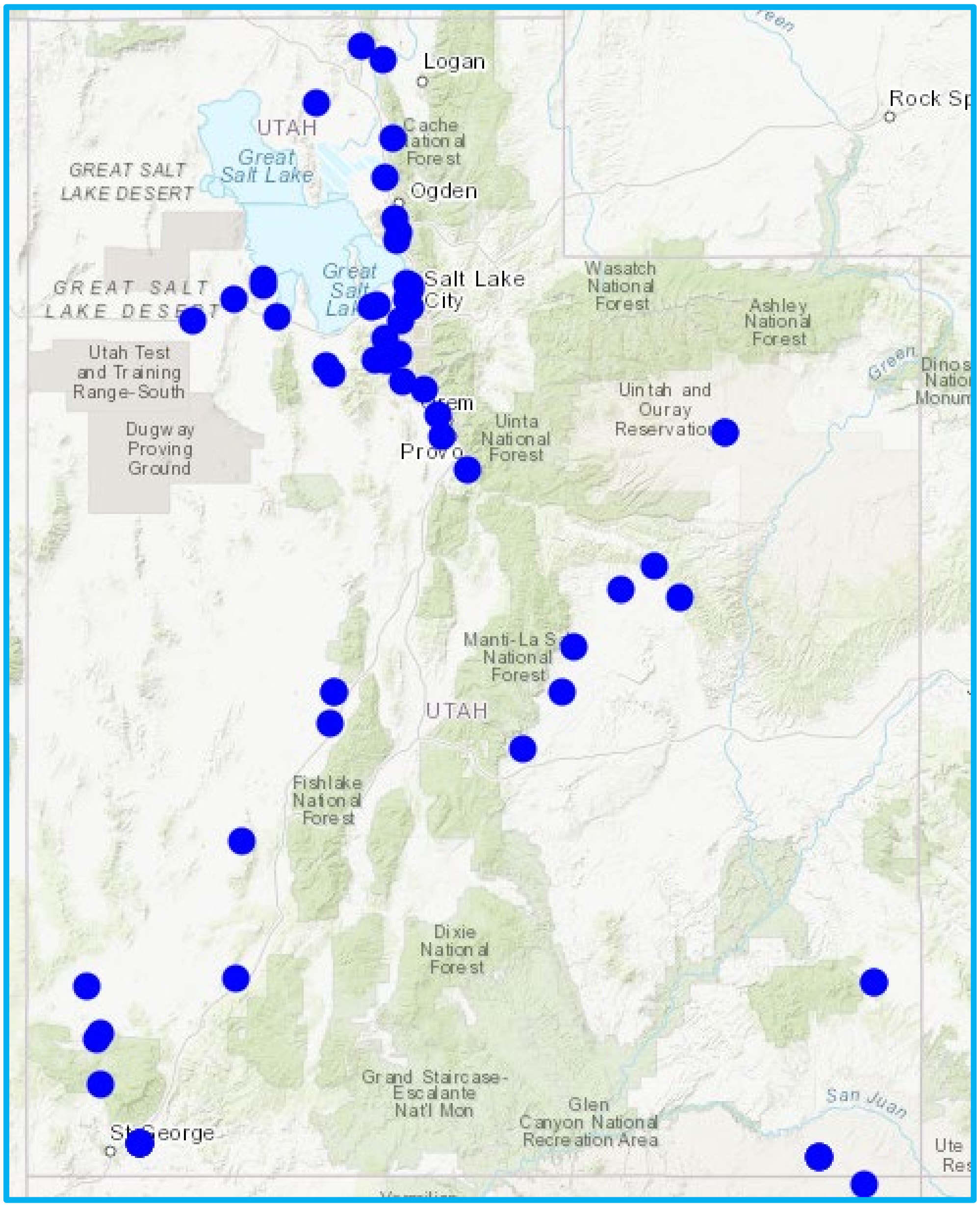



*Figure 1. Map of Power Quality Monitor Locations*

The Company utilizes monitors installed in various substations throughout PacifiCorp's transmission system in Utah to assess power quality.

*Table 1. Power Quality Monitor Location (Substation) and Data Availability*

| Monitor Location | Monitor Type | kV | Site Type | Data Availability (Months) |
|---|---|---|---|---|
| **Angel** | ION 8650 | 138 | Point of Service | 12 |
| **Arapahoe** | ION 8650 | 46 | Generation | 12 |
| **Beck Street** | ION 8650 | 138 | Point of Service | 12 |
| **Ben Lomond** | Nexus 1500 | 138 | Substation | 8 |
| **Blundell** | ION 8650 | 46 | Substation | 12 |
| **Brigham City** | ION 8650 | 138 | Substation | 12 |
| **Camp Williams** | Nexus 1252 | 345 | Substation | 8.5 |
| **Clive** | Nexus 1252 | 46 | Point of Service | 4 |
| **Columbia** | ION 8650 | 138 | Point of Service | 12 |
| **Cove Mountain** | ION 8650 | 138 | Point of Service | 12 |
| **Craner Flat** | ION 8650 | 138 | Point of Service | 12 |
| **Dugout** | ION 8650 | 46 | Point of Service | 12 |
| **Dynamo North** | ION 8650 | 138 | Substation | 12 |
| **Dynamo South** | ION 8650 | 138 | Substation | 12 |
| **Emmery** | Shark 250 | 69 | Point of Service | 2 |
| **Enterprise** | ION 8650 | 138 | Generation | 12 |
| **Enterprise Valley** | ION 8650 | 138 | Substation | 12 |
| **Goggins** | ION 8650 | 138 | Point of Service | 12 |
| **Homestead Knoll** | Nexus 1500 | 138 | Point of Service | 1 |
| **Horseshoe** | ION 8650 | 138 | Generation | 12 |
| **Hunter** | ION 8650 | 138 | Generation | 12 |
| **Kennecott** | ION 8650 | 46 | Point of Service | 12 |
| **Lampo** | ION 8650 | 138 | Generation | 12 |
| **Lone Peak** | ION 8650 | 138 | Point of Service | 12 |
| **Magna** | ION 8650 | 46 | Point of Service | 12 |
| **Mathington** | ION 8650 | 138 | Generation | 12 |
| **McCracken** | ION 8650 | 69 | Substation | 2 |
| **McFadden** | ION 8650 | 69 | Generation | 12 |
| **Milford** | ION 8650 | 46 | Point of Service | 3.5 |
| **Mountain View** | Nexus 1500 | 138 | Substation | 9.5 |
| **North Salt Lake** | KV2C | 46 | Point of Service | 12 |
| **Old Field** | ION 8650 | 46 | Substation | 12 |
| **Onion** | ION 8650 | 138 | Point of Service | 12 |
| **Oquirrh** | Nexus 1500 | 138 | Substation | 4 |
| **Parowan** | ION 8650 | 138 | Generation | 12 |
| **Pavant** | ION 8650 | 46 | Generation | 12 |
| **Pinto** | ION 8650 | 138 | Point of Service | 12 |
| **Pinto Tri-State** | ION 8650 | 69 | Substation | 12 |

| Monitor Location | Monitor Type | kV | Site Type | Data Availability (Months) |
|---|---|---|---|---|
| **Plymouth** | ION 8650 | 138 | Generation | 12 |
| **Purgatory** | ION 8650 | 138 | Substation | 12 |
| **Purgatory-Anticline** | ION 8650 | 69 | Point of Service | 12 |
| **Purgatory-Dixie** | ION 8650 | 69 | Point of Service | 12 |
| **Purgatory-Hurricane** | ION 8650 | 69 | Point of Service | 12 |
| **Purgatory-River** | ION 8650 | 69 | Point of Service | 12 |
| **Red Butte-St George** | ION 8650 | 138 | Substation | 12 |
| **Red Mesa** | ION 8650 | 69 | Substation | 4.5 |
| **Remington** | ION 8650 | 138 | Point of Service | 12 |
| **Riverdale** | Nexus 1252 | 138 | Substation | 12 |
| **San Juan** | ION 8650 | 138 | Substation | 11 |
| **Skunk Ridge** | Nexus 1500 | 46 | Substation | 10 |
| **Spanish Fork** | ION 8650 | 46 | Substation | 12 |
| **Syracuse** | ION 8650 | 46 | Substation | 11.5 |
| **Terminal** | ION 8650 | 138 | Point of Service | 12 |
| **Tooele** | ION 8650 | 46 | Point of Service | 12 |
| **Topaz** | ION 8650 | 138 | Point of Service | 12 |
| **Upalco** | ION 8650 | 138 | Point of Service | 12 |
| **Upalco-Pariette** | ION 8650 | 69 | Point of Service | 12 |
| **Wasatch Springs** | ION 8650 | 46 | Point of Service | 12 |
| **Wheelon** | Revolution | 138 | Substation | 9 |
| **Wights Fort** | ION 8650 | 138 | Point of Service | 12 |
| **Woods Cross** | KV2C | 46 | Point of Service | 12 |
| **Portable** | SEL 735 | - | Substation | Upon Request |

# 4 Assessing 2024 Power Quality

The following sections describe power quality metrics and the measurements and results of the 2024 power quality analysis. Compliance levels highlighted in yellow are sites that had measurements outside of guidelines. Further explanation, mitigation or resolution of those sites outside of guidelines are referenced in the power quality investigation section.

## 4.1 Steady State Voltage

The steady state voltage range is defined by Rocky Mountain Power 1B.3.2.2 Planning Standards for Transmission Voltages. Transmission voltage limits are 0.95 per unit to 1.06 per unit (95-106%) for looped systems and radial system's operating voltage ranges between 0.9 per unit and 1.06 (90-106%). In some situations, voltages may go as high as 1.08 per unit at non-load buses, contingent upon equipment rating review[1]. The average voltage and percentage of time that the monitoring point was within the allowable range is provided in Table 2.

*Table 2. Steady State Voltage – Per Unit*

| Monitor Location | Average (%) | Yearly Compliance (%) |
|---|---|---|
| **Angel** | 103.6 | 99.75 |
| **Arapahoe[1]** | 105 | 99.09 |
| **Beck Street** | 103.3 | 99.85 |
| **Ben Lomond** | 103.3 | 100 |
| **Blundell** | 103.7 | 99.86 |
| **Brigham City** | 103.2 | 99.75 |
| **Camp Williams** | 103.3 | 100 |
| **Clive** | 100 | 100 |
| **Columbia** | 102.9 | 100 |
| **Cove Mountain** | 103.3 | 98.61 |
| **Craner Flat** | 103.2 | 99.47 |
| **Dugout** | 103.8 | 99.66 |
| **Dynamo North** | 103.5 | 99.87 |
| **Dynamo South** | 103.5 | 99.98 |
| **Emmery** | 103.9 | 93.34 |
| **Enterprise Valley** | 103.2 | 98.95 |
| **Enterprise** | 103.6 | 98.15 |
| **Goggins** | 103.5 | 99.96 |
| **Homestead Knoll** | 102.9 | 99.92 |
| **Horseshoe** | 103.2 | 99.59 |
| **Hunter** | 102.9 | 99.88 |
| **Kennecott** | 98.5 | 99.97 |
| **Lampo** | 101.8 | 99.97 |

[1] *Electrical Power Delivery Quality Plan*, April 1, 2024, § 1.2 *Steady State Voltage—Voltage for Generators Interconnecting with the Company System*, Exception (1)

| Monitor Location | Average (%) | Yearly Compliance (%) |
|---|---|---|
| **Lone Peak** | 103.3 | 99.87 |
| **Magna** | 98.5 | 99.71 |
| **Mathington** | 103.2 | 96.12 |
| **McCracken** | 104.2 | 80.82 |
| **McFadden**[1] | 106.4 | 99.67 |
| **Milford** | 103.1 | 99.74 |
| **Mountain View** | 105.8 | 91.08 |
| **North Salt Lake** | 101.3 | 99.61 |
| **Old Field** | 104 | 86.54 |
| **Onion** | 103.3 | 99.83 |
| **Oquirrh** | 99.25 | 100 |
| **Parowan** | 104 | 96.28 |
| **Pavant**[1] | 105 | 99.05 |
| **Pinto** | 102.6 | 98.62 |
| **Pinto Tri-State** | 105.2 | 99.86 |
| **Plymouth** | 101.9 | 99.67 |
| **Purgatory** | 102.6 | 99.69 |
| **Purgatory-Anticline** | 103.4 | 93.99 |
| **Purgatory-Dixie** | 103.4 | 93.87 |
| **Purgatory-Hurricane** | 100.7 | 94.09 |
| **Purgatory-River** | 103.4 | 94.09 |
| **Red Butte-St George** | 103.2 | 99.87 |
| **Red Mesa** | 102.8 | 96.10 |
| **Remington** | 103.7 | 99.67 |
| **Riverdale** | 104 | 99.89 |
| **San Juan** | 98.2 | 99.8 |
| **Skunk Ridge** | 99.48 | 100 |
| **Spanish Fork** | 103.5 | 99.87 |
| **Syracuse** | 105 | 57.90 |
| **Terminal** | 103.2 | 99.57 |
| **Tooele** | 102.8 | 99.97 |
| **Topaz** | 103.2 | 99.99 |
| **Upalco** | 102.5 | 99.99 |
| **Upalco-Pariette** | 102.5 | 99.98 |
| **Wasatch Springs** | 101.4 | 99.81 |
| **Wheelon** | 101.6 | 99.03 |
| **Wights Fort** | 102 | 99.78 |
| **Woods Cross** | 101.6 | 100 |

## 4.2 Voltage Imbalance

The steady-state voltage imbalance is to be less than 3% at the customer's point of service. While transmission voltage is regulated at distribution feeders, voltage imbalance is maintained for best electrical practices. The average voltage imbalance and percentage of time that the monitoring point was within the allowable range is provided in Table 3. Voltage imbalance levels are within power quality standards and industry practices.

*Table 3. Voltage Imbalance*

| Monitor Location | Average (%) | Yearly Compliance (%) |
|---|---|---|
| **Angel** | 0.08 | 99.91 |
| **Arapahoe** | 0.25 | 99.94 |
| **Beck Street** | 0.09 | 99.98 |
| **Ben Lomond** | 0.08 | 100 |
| **Blundell** | 0.28 | 99.97 |
| **Brigham City** | 0.1 | 99.96 |
| **Camp Williams** | 0.28 | 100 |
| **Clive** | 0.35 | 100 |
| **Columbia** | 0.29 | 100 |
| **Cove Mountain** | 0.77 | 99.98 |
| **Craner Flat** | 0.33 | 99.94 |
| **Dugout** | 0.33 | 99.98 |
| **Dynamo North** | 0.09 | 99.99 |
| **Dynamo South** | 0.1 | 99.98 |
| **Emmery** | 0.11 | 100 |
| **Enterprise Valley** | 0.86 | 99.84 |
| **Enterprise** | 0.8 | 99.99 |
| **Goggins** | 0.11 | 99.99 |
| **Homestead Knoll** | 0.19 | 100 |
| **Horseshoe** | 0.27 | 99.88 |
| **Hunter** | 0.07 | 99.83 |
| **Kennecott** | 0.09 | 99.99 |
| **Lampo** | 0.13 | 99.96 |
| **Lone Peak** | 0.14 | 99.99 |
| **Magna** | 0.09 | 99.99 |
| **Mathington** | 0.21 | 99.90 |
| **McCracken** | 0.38 | 99.96 |
| **McFadden** | 0.11 | 99.90 |
| **Milford** | 0.21 | 99.98 |
| **Mountain View** | 0.06 | 100 |
| **North Salt Lake** | 0.26 | 100 |
| **Old Field** | 0.28 | 99.94 |
| **Onion** | 0.09 | 99.97 |
| **Oquirrh** | 0.09 | 99.99 |

| Monitor Location | Average (%) | Yearly Compliance (%) |
|---|---|---|
| Parowan | 0.25 | 100 |
| Pavant | 0.25 | 99.94 |
| Pinto | 0.5 | 99.98 |
| Pinto Tri-State | 0.53 | 99.96 |
| Plymouth | 0.16 | 99.79 |
| Purgatory | 0.36 | 99.99 |
| Purgatory-Anticline | 0.36 | 99.99 |
| Purgatory-Dixie | 0.35 | 99.99 |
| Purgatory-Hurricane | 1.34 | 99.31 |
| Purgatory-River | 0.35 | 99.99 |
| Red Butte-St George | 0.44 | 99.96 |
| Red Mesa | 0.36 | 99.93 |
| Remington | 0.14 | 100 |
| Riverdale | 0.15 | 100 |
| San Juan | 0.51 | 99.94 |
| Skunk Ridge | 0.34 | 100 |
| Spanish Fork | 0.16 | 99.98 |
| Syracuse | 0.17 | 99.97 |
| Terminal | 0.36 | 99.97 |
| Tooele | 0.1 | 99.87 |
| Topaz | 0.08 | 99.89 |
| Upalco | 0.37 | 99.99 |
| Upalco-Pariette | 0.33 | 99.99 |
| Wasatch Springs | 0.19 | 99.99 |
| Wheelon | 0.12 | 100 |
| Wights Fort | 0.09 | 99.91 |
| Woods Cross | NA | NA |

## 4.3 Voltage Sag Events

Power quality monitoring is configured to trigger the recording of a sag when voltage exceeds (+/-)10% of nominal voltage at the monitoring point. Customers will observe varying impacts to their equipment for voltage sags occurring above the SEMI-F47 line (see Figure 2 and Informational Section – Baseline Power Quality Standards for example SEMI-F47 plot). Electrical equipment that experiences events below the SEMI-F47 will likely cease operation or enter an auxiliary state to prevent equipment damage. As unique events will be captured by multiple monitors, Table 4 provides the total number of events at each site. There were 478 unique events[2].

*Table 4. Voltage Sag/Swell*

| Monitor Location | Ride Through | Sag | Surge | Total Events |
|---|---|---|---|---|
| **Angel** | 48 | 5 | - | 53 |
| **Arapahoe** | 28 | 5 | - | 33 |
| **Beck Street** | 48 | 2 | - | 50 |
| **Ben Lomond** | 61 | 3 | - | 64 |
| **Blundell** | 22 | 1 | 2 | 25 |
| **Brigham City** | 68 | - | - | 68 |
| **Clive** | - | 2 | - | 2 |
| **Cove Mountain** | 23 | 4 | - | 27 |
| **Craner Flat** | 61 | 2 | - | 63 |
| **Dugout** | 30 | 2 | 1 | 33 |
| **Dynamo North** | 35 | 2 | - | 37 |
| **Emmery** | 4 | - | - | 4 |
| **Enterprise** | 22 | 3 | 1 | 26 |
| **Enterprise Valley** | 22 | 2 | - | 24 |
| **Homestead Knoll** | 51 | 3 | - | 54 |
| **Horseshoe** | 56 | 2 | - | 58 |
| **Hunter** | 22 | - | - | 22 |
| **Kennecott** | 76 | 2 | - | 78 |
| **Lone Peak** | 47 | - | - | 47 |
| **Magna** | 83 | 2 | - | 85 |
| **Mathington** | 33 | 3 | 1 | 37 |
| **McCracken** | 1 | 2 | 6 | 9 |
| **McFadden** | 11 | 5 | - | 16 |
| **Milford** | 3 | 5 | - | 8 |
| **Mountain View** | 41 | 1 | - | 42 |
| **North Salt Lake** | 31 | 1 | - | 32 |
| **Old Field** | 43 | 5 | - | 48 |
| **Onion** | 47 | 2 | 1 | 50 |

[2] A unique event is the number of events produced by a single cause but impacted multiple monitoring locations.

| Monitor Location | Ride Through | Sag | Surge | Total Events |
|---|---|---|---|---|
| **Oquirrh** | 47 | 15 | - | 62 |
| **Parowan** | 25 | 1 | 1 | 27 |
| **Pinto** | 16 | 1 | - | 17 |
| **Remington** | 46 | 3 | - | 49 |
| **Riverdale** | - | 3 | - | 3 |
| **San Juan** | 50 | 16 | 1 | 67 |
| **Skunk Ridge** | 59 | 4 | - | 63 |
| **Topaz** | 49 | 2 | - | 51 |
| **Wasatch Springs** | 55 | 3 | - | 58 |
| **Wheelon** | 48 | 2 | - | 50 |
| **Wights Fort** | 50 | 2 | 1 | 53 |
| **Woods Cross** | 28 | 1 | - | 29 |

*Figure 2. Event Location Identification in Reference to the SEMI-F47 Curve*

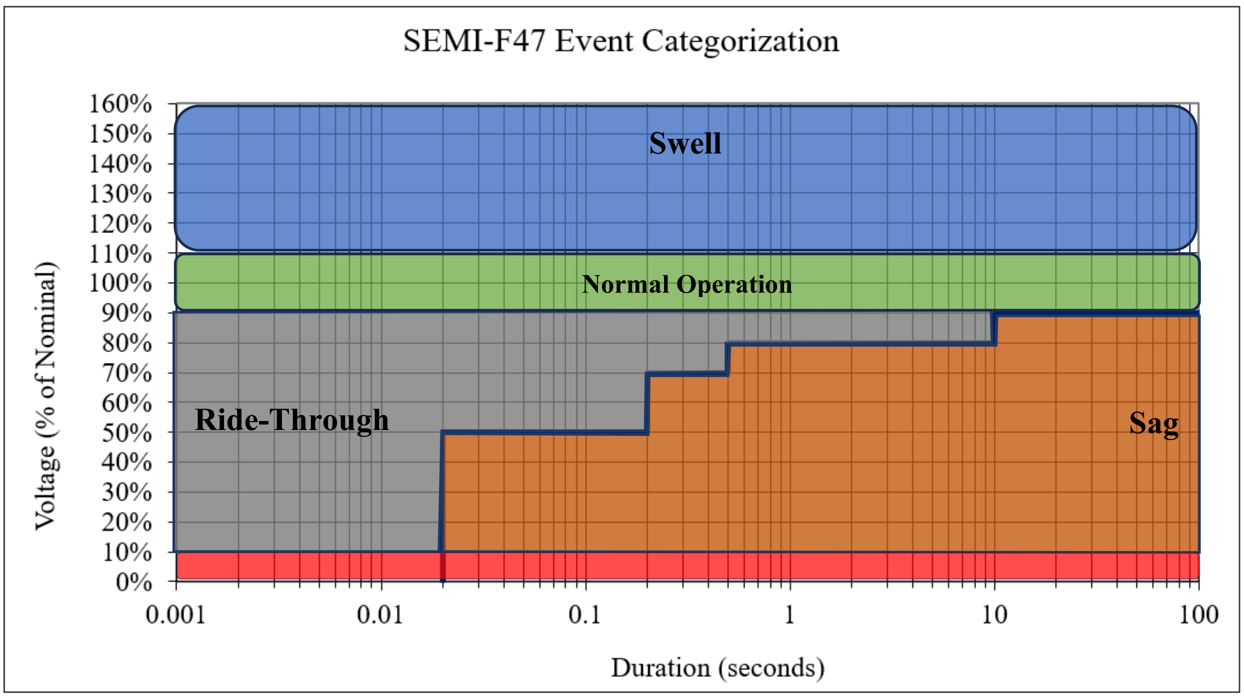



*Figure 2 Event location identification in reference to the SEMI-F47 curve. Events less than 10% of any duration were not included as IEEE 1159 defines events less than 10% to be an interruption.*

## 4.4 Voltage Total Harmonic Distortion

Table 5 below quantifies the annual average of the voltage total harmonic distortion (VTHD), the percentage of weeks that the location meets the IEEE 519 Weekly 95th percentile limit, and the VTHD limit for the voltage class. Monitors with N/A did not have harmonic data available.

*Table 5. Voltage Harmonic Distortion*

| Monitor Location | Harmonic Limit | Annual AVG | IEEE 519 Weekly Compliance (%) |
|---|---|---|---|
| Angel | 2.5 | 0.87 | 100 |
| Arapahoe | 5 | 1.67 | 100 |
| Beck Street | 2.5 | 0.61 | 100 |
| Ben Lomond | 2.5 | 0.82 | 100 |
| Blundell | 5 | 0.97 | 100 |
| Brigham City | 2.5 | 0.87 | 100 |
| Camp Williams | 1.5 | 0.61 | 96.9 |
| Clive | 5 | 2.3 | 100 |
| Columbia | 2.5 | 0.85 | 100 |
| Cove Mountain | 2.5 | 1 | 100 |
| Craner Flat | 2.5 | 1.06 | 100 |
| Dugout | 5 | 2.04 | 100 |
| Dynamo North | 2.5 | 0.8 | 100 |
| Dynamo South | 2.5 | 0.8 | 100 |
| Emery | 5 | 4.27 | 11.1 |
| Enterprise | 2.5 | 1.04 | 100 |
| Enterprise Valley | 2.5 | 0.99 | 100 |
| Goggins | 2.5 | 0.64 | 100 |
| Homestead Knoll | 2.5 | 0.92 | 100 |
| Horseshoe | 2.5 | 1.01 | 100 |
| Hunter | 2.5 | 0.73 | 100 |
| Kennecott | 5 | 1.3 | 100 |
| Lampo | 2.5 | 1.41 | 100 |
| Lone Peak | 2.5 | 0.63 | 100 |
| Magna | 5 | 0.58 | 100 |
| Mathington | 2.5 | 0.63 | 100 |
| McCracken | 5 | 2.76 | 75 |
| McFadden | 5 | 0.8 | 100 |
| Milford | 5 | 1.72 | 100 |
| Mountain View | 2.5 | 0.64 | 100 |
| North Salt Lake | 5 | NA | NA |
| Old Field | 5 | 2.75 | 92.3 |
| Onion | 2.5 | 0.72 | 100 |
| Oquirrh | 2.5 | 0.76 | 100 |

| Monitor Location | Harmonic Limit | Annual AVG | IEEE 519 Weekly Compliance (%) |
|---|---|---|---|
| **Parowan** | 2.5 | 1.06 | 100 |
| **Pavant** | 5 | 1.67 | 100 |
| **Pinto** | 2.5 | 1.64 | 40.4 |
| **Pinto Tri-State** | 5 | 1.76 | 100 |
| **Plymouth** | 2.5 | 2.24 | 21.7 |
| **Purgatory** | 2.5 | 1.23 | 100 |
| **Purgatory-Anticline** | 5 | 1.33 | 100 |
| **Purgatory-Dixie** | 5 | 1.32 | 100 |
| **Purgatory-Hurricane** | 5 | 1.36 | 100 |
| **Purgatory-River** | 5 | 1.32 | 100 |
| **Red Butte-St George** | 2.5 | 1.05 | 100 |
| **Red Mesa** | 5 | 2.79 | 71.4 |
| **Remington** | 2.5 | 0.64 | 100 |
| **Riverdale** | 2.5 | NA | NA |
| **San Juan** | 2.5 | 2.87 | 0 |
| **Skunk Ridge** | 5 | 1.7 | 100 |
| **Spanish Fork** | 5 | 0.78 | 100 |
| **Syracuse** | 5 | 4.04 | 38.46 |
| **Terminal** | 2.5 | 1.1 | 100 |
| **Tooele** | 5 | 0.9 | 100 |
| **Topaz** | 2.5 | 0.97 | 100 |
| **Upalco** | 2.5 | 1.23 | 100 |
| **Upalco-Pariette** | 5 | 1.54 | 100 |
| **Wasatch Springs** | 5 | 0.79 | 100 |
| **Wheelon** | 2.5 | 0.87 | 97.5 |
| **Wights Fort** | 2.5 | 0.72 | 100 |
| **Woods Cross** | 5 | NA | NA |

## 4.5 Flicker - Pst 10 Minute

The IEEE 1453 evaluation was performed for each site for each week of the year. The column IEEE 1453 Weekly Compliance (%) represents the percentage of weeks for the year where voltage flicker levels complied with IEEE 1453 standards. Monitors with N/A did not have flicker data available.

*Table 6. 0.8 Min Pst Light Flicker*

| Site Location | Limit | IEEE 1453 Weekly Compliance (%) |
|---|---|---|
| **Angel** | 0.8 | 100 |
| **Arapahoe** | 0.8 | 100 |
| **Beck Street** | 0.8 | 100 |
| **Ben Lomond** | 0.8 | 100 |
| **Blundell** | 0.8 | 100 |
| **Brigham City** | 0.8 | 75 |
| **Camp Williams** | 0.8 | NA |
| **Clive** | 0.8 | NA |
| **Columbia** | 0.8 | NA |
| **Cove Mountain** | 0.8 | 100 |
| **Craner Flat** | 0.8 | 100 |
| **Dugout** | 0.8 | 100 |
| **Dynamo North** | 0.8 | 100 |
| **Dynamo South** | 0.8 | NA |
| **Emmery** | 0.8 | NA |
| **Enterprise** | 0.8 | 100 |
| **Enterprise Valley** | 0.8 | 100 |
| **Goggins** | 0.8 | NA |
| **Homestead Knoll** | 0.8 | 100 |
| **Horseshoe** | 0.8 | 100 |
| **Hunter** | 0.8 | 100 |
| **Kennecott** | 0.8 | 100 |
| **Lampo** | 0.8 | NA |
| **Lone Peak** | 0.8 | 100 |
| **Magna** | 0.8 | 100 |
| **Mathington** | 0.8 | 100 |
| **McCracken** | 0.8 | 100 |
| **McFadden** | 0.8 | 98.1 |
| **Milford** | 0.8 | 100 |
| **Mountain View** | 0.8 | NA |
| **North Salt Lake** | 0.8 | NA |
| **Old Field** | 0.8 | 98.1 |
| **Onion** | 0.8 | 100 |
| **Oquirrh** | 0.8 | NA |

| Site Location | Limit | IEEE 1453 Weekly Compliance (%) |
|---|---|---|
| **Parowan** | 0.8 | 98.1 |
| **Pavant** | 0.8 | NA |
| **Pinto** | 0.8 | 100 |
| **Pinto Tri-State** | 0.8 | NA |
| **Plymouth** | 0.8 | NA |
| **Purgatory** | 0.8 | NA |
| **Purgatory-Anticline** | 0.8 | NA |
| **Purgatory-Dixie** | 0.8 | NA |
| **Purgatory-Hurricane** | 0.8 | NA |
| **Purgatory-River** | 0.8 | NA |
| **Red Butte-St George** | 0.8 | NA |
| **Red Mesa** | 0.8 | NA |
| **Remington** | 0.8 | 100 |
| **Riverdale** | 0.8 | NA |
| **San Juan** | 0.8 | 94.2 |
| **Skunk Ridge** | 0.8 | NA |
| **Spanish Fork** | 0.8 | NA |
| **Syracuse** | 0.8 | NA |
| **Terminal** | 0.8 | NA |
| **Tooele** | 0.8 | NA |
| **Topaz** | 0.8 | NA |
| **Upalco** | 0.8 | NA |
| **Upalco-Pariette** | 0.8 | NA |
| **Wasatch Springs** | 0.8 | 100 |
| **Wheelon** | 0.8 | 33.3 |
| **Wights Fort** | 0.8 | 100 |
| **Woods Cross** | 0.8 | NA |

# 5 Assessing Utility-Scale Interconnections

All interconnection studies in 2024 utilized the Company's standard procedures including policy 139. No other technical studies were conducted or required.

# 6 Addressing Power Quality Issues and Proposed Modifications

## 6.1 Power Quality Investigations

### 6.1.1 Steady State Voltage

**Old Field** – Periods of high voltage were due to reactive power flow on the transmission system relative to the load and light loading in the winter season. Rocky Mountain Power is reviewing control settings of reactive power components with their operators to coordinate adjustments and mitigate high voltage.

**Syracuse** – A transmission customer's equipment was increasing the voltage at the monitoring point. Voltage at the nearest transmission customer was within transmission voltage ranges. The high voltage is isolated to the customer facility and they have been made aware of the voltage impact on their own facilities.

### 6.1.2 Voltage Imbalance

Voltage imbalance on the transmission system and interconnection locations is maintained to Company standards.

### 6.1.3 Voltage Sag/Swell Events

**Mathington -** The combination of a solar facility's equipment operations, the output of regional generation resources, and a Company voltage regulation device resulted in voltage oscillation events and voltage swells on the Mathington 138-kilovolt system. The solar facility was disconnected for a short period until a solution could be determined. The solar operator implemented alterations to the voltage regulation settings which mitigated voltage oscillatory events from recurring.

**McCraken –** Voltage variations were found at a point of common coupling for a neighboring utility that operates inverter-based resources. The neighboring utility has been notified of the variations. The voltage on the Company's network is not adversely affected by the neighboring utility's voltage variations.

### 6.1.4 Voltage Total Harmonic Distortion

**Emery** – Voltage harmonic levels are a result of a transmission customer's current harmonic injection. The Company contacted the customer and the customer responded by reducing their current harmonic distortion levels, thus improving the voltage total harmonic distortion levels to within standards.

**Plymouth** – Voltage total harmonic distortion outside standards is a result of a transmission customer's current harmonic injection. While outside of guidelines at this customer's point of service, the nearest neighboring customer does not see voltage harmonic distortion at their point of service. No further mitigation is required.

**San Juan –** Voltage total harmonic distortion is a result of current harmonics injected by a transmission customer's equipment. The customer has been notified of these findings, and the Company is working with the customer on a mitigation plan.

**McCracken/Pinto/Red Mesa** – The voltage harmonic levels are a result of the current harmonic injection at the upstream San Juan substation from a transmission customer. The customer has been contacted about the issue and requested to investigate mitigation measures.

**Syracuse** – A transmission customer operates equipment that creates a parallel resonance response producing excessive voltage harmonics. The customer has been notified and is considering options to prevent harmonics while retaining the benefits of the existing equipment.

#### 6.1.5 Flicker - Pst 10 Minute

**Brigham City/Wheelon** – A transmission customer's highly variable load induces small and rapid voltage disturbances on the transmission network. The customer has installed a static var compensator and the Company has interconnected another transmission source to reduce flicker for medium and low voltage customers. While the point of service is still slightly outside of standard levels, the nearest neighboring customers' flicker levels are within standard levels.

# 7 Informational Section - Baseline Power Quality Standards

## 7.1 Voltage magnitude

The regulation of the voltage magnitude of the transmission network is defined in Table 2 and the root mean square (RMS) values are to be maintained between those bounds. The transmission network is operated to an expected baseline to meet Table 2.

*Table 7 Voltage classification - 1B.1 (2. Definitions) PacifiCorp Engineering Handbook*

| Voltage Range | Network Classification | Subclassification |
|---|---|---|
| 230kV & Above | Transmission | Extra High Voltage (EHV) |
| 46 – 161 kV | Subtransmission | High Voltage (HV) |
| 1 – 34.5 kV | Distribution | Medium Voltage (MV) |
| Less than 1kV | Service | Low Voltage (LV) |

*Table 8 Permissible voltage range for the transmission network. 1.B.3 (3.2 Voltage Ranges) PacifiCorp Engineering Handbook*

| Operating Mode | Normal Operation | | Outage Conditions[2] | |
|---|---|---|---|---|
| System Configuration | **Looped** | **Radial** | **Looped** | **Radial** |
| Max Voltage | 1.06[1] | 1.06[1] | 1.10 | 1.10 |
| Min Voltage | 0.95 | 0.90 | 0.90 | 0.85 |

1. In some situations, voltages may go as high as 1.08 pu at non-load buses, contingent upon equipment rating review.
2. Voltages immediately after a system emergency may fall outside these ranges before system adjustments occur to bring the voltage level up to, or above the minimum acceptable level, or down to, or below the maximum acceptable level.

**Voltage for Generators Interconnecting with the Company System**

All non-company-owned generation entities that interconnect with the company system, such as Qualifying Facilities (QFs) and Independent Power Producers (IPPs), must include language in their contract that defines the voltage profile requirements to be held under specific system conditions. Generators causing service voltages outside of ANSI ranges A or B as applicable will be required to mitigate their operation to comply with standard voltage ranges.

## 7.2 Voltage Imbalance

The Company's baseline for voltage imbalance is found in Appendix D of ANSI Std. C84.1, Voltage Ratings for Electrical Power Systems and Equipment. The electric supply systems are designed and operated to a maximum voltage imbalance of **three percent** when measured at the electric utility revenue meter.

## 7.3 Voltage Fluctuations

### 7.3.1 Repetitive Voltage Fluctuations & Flicker Limits

Repetitive voltage fluctuations alter the quality of lighting as perceived by customers. Repetitive voltage fluctuations are addressed by IEEE 1453. Flicker events caused by fluctuating voltage under any load on its power system shall not exceed the Pst or Plt values shown in Table 8 or 9. Specific tools for the planning of large fluctuating loads are found in IEEE 1453.1. Individual compatibility problems between existing LV & MV customers are resolved at the Pst = 1.0 level, and future MV installations are more conservatively planned for the Pst = 0.9 level.

*Table 9 Flicker Compatibility and Planning Levels. 1C.5.1 (4.1.4 Specific Flicker Limits) PacifiCorp Engineering Handbook*

| | Compatibility Levels | Planning Levels | |
|---|---|---|---|
| **Voltage Level** | **LV & MV** | **MV** | **HV & EHV** |
| Pst | 1.0 | 0.9 | 0.8 |
| Plt | 0.8 | 0.7 | 0.6 |

IEEE methodology permits the limits to be exceeded between 1% and 5% of the time over a one-week measurement period. If the times-of-day of exceedance were objectionable, such as during the evenings when many people had lights turned on in their homes, then the 1% limit applies. If the fluctuating load could commit to nocturnal exceedance, then the Pst limit can permit a 5% exceedance. If the large flickering loads cannot ensure nocturnal operation, then the 1% exceedance limit is enforced.

### 7.3.2 Voltage Sags and Swells due to Short Circuits

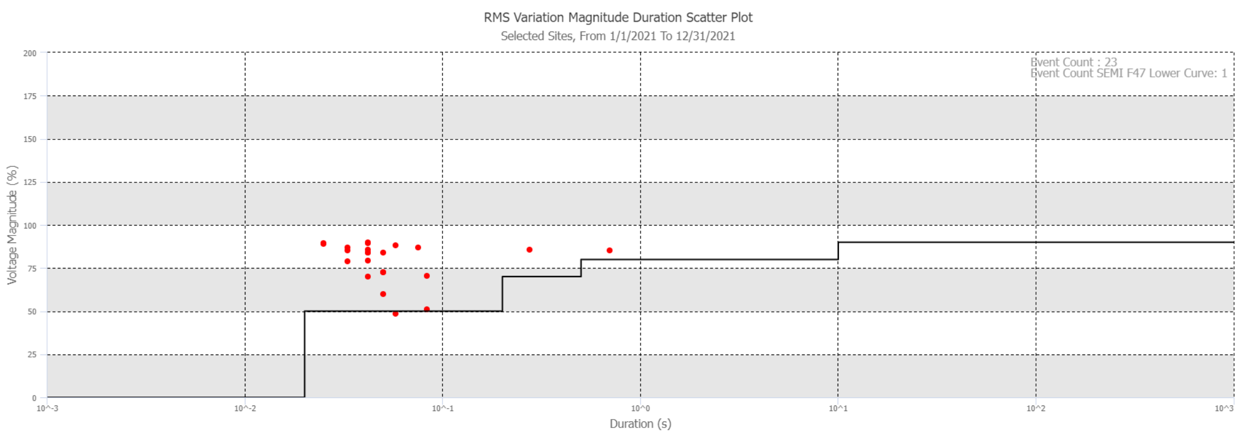
Electrical system faults are the most troublesome and common power quality issue for customers. Faults can cause direct outages to customers if the customer is located on a line that is faulted, however they can also be affected indirectly as the fault will cause a voltage sag to lines adjacent to the faulted line.

Faults occur whenever lightning hits the line, power lines slap together from excessive wind, or when a power line falls to the ground, such as when a power pole is hit by a vehicle. They also occur when tree branches contact the power lines and they occur during a rainstorm when a substantial amount of dust is stirred up, thus compromising the effectiveness of the line insulators. The clearing of these faults is necessary to prevent catastrophic damage to the electrical system, and to ensure public safety. As the origin of most faults are not within the Company's control the development of a quantitative limit has not been created. The Company implements industry practices to locate and remove faults from the system and encourages customers to develop processes and use voltage sag ride-through technologies to accommodate for fault clearing.

Power quality monitoring is configured to trigger the recording of a sag/swell log or waveform capture when voltage RMS values drop below 90% of the rated voltage of the service or monitoring point.

### 7.3.3 Customer Ride-Through Recommendation

The Company encourages customers to implement appropriate voltage sag ride-through protocols to ensure that equipment interruptions occur because of a system design to meet safety and equipment protection guidelines. The hardening of control and LV systems can maximize the ride-through of a site. The Company recommends the use of SEMI-F47 ride-through analysis for low voltage control equipment in lieu of the CBEMA or ITIC. Below is an example SEMI-F47 plot showing multiple voltage sags, but only one occurring “below the line”. Below the line events will likely cause an issue for customers, but the expectation is for customers to be able to “ride through” events above the line.




## 7.4 Voltage and Current Distortion

Harmonic distortion is commonly produced by customer equipment injecting electrical noise into the power system. This will degrade PacifiCorp’s service to other customers. Maintaining electrical noise within tolerable limits will allow PacifiCorp to provide quality electrical service to all its customers. The customer shall take necessary action, at the customer’s sole expense, for the customer’s facility to stay within these limits.

### 7.4.1 Voltage Harmonic Distortion Limits

It is the Company’s responsibility to provide quality voltage to all its customers. Customers keeping the current distortion within their limits of 1C.4.1 Section 8 will allow the Company to provide this service. This service is defined as voltage having distortion levels within the limits of Table 5. The VTHD limits are the same as in 1C.4.1 Section 3.1 and are for normal operation. During start-ups, shutdowns or unusual non-steady state conditions these limits may be exceeded up to 50%

*Table 10 Voltage THD limits. 1C.4.1 (7 Table 2)*

| Bus Voltage at PCC | Individual Harmonic Voltage Distortion (%) | Total Voltage Distortion THD (%) |
|---|---|---|
| 1.0 ≤ 69kV | 3.0 | 5.0 |
| 69 kV < $V_{rms}$ ≤ 161 kV | 1.5 | 2.5 |
| $V_{rms}$ > 161 kV | 1.0 | 1.5 |

### 7.4.2 Current Total Demand Distortion Limits

Current distortion occurs when customer equipment draws current from the utility in a nonlinear or choppy manner. It always produces harmonics in the load current waveform and can produce significant harmonics in the voltage waveform at the point of common coupling (PCC) and elsewhere.

Determination of current total demand distortion (CTDD) requires the collection of site's load current $I_L$ and the $I_{SC}$ to determine the $I_{SC}/I_L$ ratio. A higher ratio permits a greater TDD value. Determination of compliance to compliance of the IEEE Standard 519 is completed on a case-by-case basis if VTHD is found to be out of compliance. Implementation of widespread IEEE 519 capable metering would be cumbersome in data and not cost effective for customers. If compliance of a site needs to be determined the statistical analysis of 1C.4.1 Section 8 is used to determine acceptable exceedances and enforcement.

- Measured over a period of 24 hours, 99th percentile very short time (3 sec.) harmonic currents should be less than 2.0 times the values given in 1C.4.1 Section 8
- Measured over a period of 7 days, 99th percentile short time (10 min.) harmonic currents should be less than 1.5 times the values given in 1C.4.1 Section 8

Measured over a period of 7 days, 95th percentile short time (10 min.) harmonic currents should be less than the values given in Section 8

# 8 Glossary

**ANSI –** American National Standards Institute

**CBEMA –** Computer & Business Equipment Manufacturer's Association

**CBEMA Curve –** Ride-through curve developed in 1977 to determine utility power supply requirements for early mainframe computer power supplies

**CE –** Product marking indicating Conformité Européenne, conforming to European Union standards for health and safety of electrical components.

**Company –** Represents the entity PacifiCorp d.b.a Rocky Mountain Power

**CTDD –** Current Total Demand Distortion.

**IEEE –** Institute of Electrical and Electronics Engineers

**ITIC –** Information Technology Industry Council

**ITIC Curve –** Ride-through curve developed in 2000 for 120V 60Hz power supplies of information technology. Application of the curve to higher voltage or systems other than power supplies intended for IT systems has variable value.

**ITE –** Information technology equipment

**kV –** kilovolt

**Monitor –** Device with a primary purpose to measure system values to determine utility and customer compliance with Company power quality standards

**Meter –** Device with a primary purpose of recording energy use by a customer with ancillary power quality monitoring capabilities.

**Pst -** Perception of light flicker in the short term. Short term is defined as a 10-minute interval.

**PCC** – Point of Common Coupling, nearest point on the power system where a potentially offending electrical load could be observed or impact another customer. In the absence of clear agreement on where the PCC is located, the PCC shall be defined as the point where the power system containing the offending load attaches to PacifiCorp's power system.

**PU –** The per-unit value of any quantity is defined as the ratio of actual value in any unit to the base or reference value in the same unit. Any quantity is converted into per unit quantity by dividing the numeral value by the chosen base value of the same dimension.

**SEMI-F47 Curve –** Voltage sag ride-through curve developed by the semiconductor manufacturing industry to ensure that control and manufacturing equipment would not require operator intervention. Implementation of a ride-through curve requirements to applicable control equipment ensures that equipment drop-off is not a result of PLC or control terminal sensitivity but determined by the equipment's operational limitations and safety requirements.

**RMS -** The Root Mean Square (RMS) is the mathematical method for determining the effective voltage for a continuous alternating current (AC) wave, also known as a sine wave. It is defined as the square root of the mean of the squares of the values. This is also known as the quadratic mean.

**UL –** Underwriters Laboratories certification of safety for electrical equipment

**VTHD –** Voltage Total Harmonic Distortion.