



EAGLE EYE

TECHNICAL NOTE

Title	Is Your Utility Substation DC Power System Prepared for Extreme Summer Weather?
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Revision History

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5/22/25	0	Initial issue	JAB

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Introduction

A recent report conducted by NERC (North American Electric Reliability Conference) highlights the increased risk of power outages this summer – with demand sharply increasing (more data centers, more AC needed with rising temps, etc.) and no improvement to current grid infrastructure in sight.

In fact, the U.S. is projected to need an additional 10 gigawatts more electricity in the upcoming summer than it did last year – the equivalent of what it takes to keep the lights on in roughly 10 million households.

“With higher demand and less firm resources,” the NERC report says that the power grid “is at an elevated risk of operating reserve shortfalls during periods of high demand or low resource output.”

The Importance of Battery Backup Power

With the increase in grid unpredictability, utility substations increasingly rely on DC battery systems as backup power sources to ensure uninterrupted power for critical operations during outages.

Batteries have become the backbone of grid resiliency. However, without proper maintenance, their performance can easily degrade, leading to costly downtime, equipment damage, non-compliance, and other negative consequences associated with a loss of critical power systems.

This technical note outlines best practices for maintaining these critical DC battery systems in order to maximize battery reliability and lifespan.

Challenges in DC Battery Maintenance

Substation DC batteries, often lead-acid or nickel-cadmium chemistries, operate in demanding environments with temperature fluctuations, high humidity, and continuous cycling. Common issues include:

- **Sulfation and Capacity Loss** – Over time, lead-acid batteries develop sulfate crystals, reducing capacity and runtime.
- **Electrolyte Imbalance** – Improper electrolyte levels can lead to corrosion or dry-out, compromising battery health.
- **Connection Degradation** – Loose or corroded connections increase resistance, leading to voltage drops and potential failures.
- **Lack of Real-Time Data** – Manual inspections often miss early warning signs of battery degradation, such as abnormal voltage or temperature.

- **Compliance Gaps** – Failing to document maintenance activities can result in penalties under regulatory standards.

These challenges highlight the need for proactive maintenance strategies supported by advanced tools and systems to ensure optimal performance

Best Practices for Battery Maintenance

1. Regular Visual Inspections

Monthly visual checks of terminals, connectors, and racks for signs of wear and tear can provide insights into conditions that may negatively impact the battery's performance over time.

2. Voltage and Specific Gravity Measurements

Quarterly measurements of individual cell voltages and specific gravity levels with a hydrometer allow technicians to accurately assess electrolyte health, ensuring there are no deviations from manufacturer specifications to signal the need for corrective action.

3. Temperature Monitoring

Maintaining ambient temperatures between 20-25C (68-77F) will optimize battery lifespan. Using thermal sensors to detect hot spots or abnormal heat buildup may indicate overcharging or internal faults.

4. Capacity Testing

Annual load bank testing will verify battery capacity under simulated outage conditions to determine if replacement is necessary. This is critical for compliance with NERC standards.

5. Connection Maintenance

Semi-annually cleaning and tightening all connections will minimize resistance. Using a torque wrench to ensure proper tightness and applying anti-corrosion coatings to terminals will help to prevent degradation.

6. Automated Monitoring Systems

Battery monitoring systems can also track key parameters like voltage, current, temperature, and internal resistance in real-time and without the need for manual labor. They can alert for anomalies and trends, enabling proactive intervention before failures occur.

7. Electrolyte Management

Monthly electrolyte level checks will allow technicians to top off with distilled water as needed – careful to avoid overfilling, which can cause spills and corrosion.

8. Charger Maintenance

Annual charger calibration will ensure battery chargers deliver the correct float voltage to prevent over- or undercharging, also verifying that they switch seamlessly between float and equalize modes to maintain battery health.

9. Documentation and Reporting

Using software to generate and maintaining detailed records of all maintenance activities, including test results, visual inspections, and corrective actions will ensure adherence to NERC PRC-005-6 compliance requirements.

Protect Your DC Equipment Investment and Be Prepared with Proactive Maintenance

Implementing these practices yields significant benefits:

- **Enhanced Reliability** Well-maintained batteries ensure uninterrupted power during outages, maintaining critical substation functions.
- **Extended Lifespan** Proper care can extend battery life by 20-30%, reducing replacement costs and getting the most out of your investment.
- **Regulatory Compliance** Automated monitoring and reporting simplify adherence to NERC compliance standards, avoiding penalties and maintaining reliability.
- **Cost Savings** Early detection of issues prevents expensive emergency repairs and even more costly downtime.

Conclusion

Effective DC battery maintenance is critical for utility substations to ensure grid reliability, compliance, and safety. By combining regular inspections, advanced battery monitoring, and proper documentation, utilities can mitigate risks and optimize long-term battery performance. Investing in the right tools and strategies is essential to address the challenges of battery maintenance and maintain a resilient power infrastructure – even during extreme weather and increased demands on the grid.

For more information on advanced battery maintenance solutions, consult Eagle Eye Power Solutions at info@eepowersolutions.com.