

# Electrical Systems

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*Note: This chapter is derived from information in the Bureau of Reclamation (2020)*

## Practical Requirements for Electrical Maintenance

To maintain a complex electrical system effectively, you need more than just a toolbox; you need a structured Preventive Maintenance (PM) program. Practically speaking, this involves three core pillars:

**Administrative tools and documentation** are important for proper maintenance. An asset management system, such as the Capital Asset and Resource Management Application (CARMA), is used to monitor the condition of equipment and to ensure that work orders are scheduled at the right time. Documentation is not just paperwork, but a way to keep track of equipment condition over time. By analysing this data, potential failures can be predicted before they occur.

**Safety and protective gear** are essential because maintenance work can involve serious hazards, such as high-voltage equipment and arc flashes. Personal Protective Equipment (PPE) must therefore be properly maintained. This includes rubber insulating gloves and blankets, which need to be tested every six months, and arc-rated clothing, which must be kept clean and free from grease or oil to remain effective.

**Specialised testing equipment** is also required to carry out reliable maintenance. Tools must be properly calibrated to ensure accurate measurements. Examples include infrared cameras for detecting hot spots in energized equipment, Dissolved Gas Analysis tools for analysing transformer oil, and micro-ohm meters for measuring connection resistance in battery banks. Equipment used for regulatory purposes must be calibrated annually.

## Electrical Maintenance Schedule

The following table outlines the practical tasks and intervals required to keep a facility's critical electrical systems in service.

Equipment Category	Maintenance Task	Interval
Safety / PPE	Visual inspection of ground cables and live-line tools.	Before each use
Safety / PPE	Electrical testing of rubber insulating gloves and blankets.	Every 6 months

Annunciators	Test alarm circuits (Test button) and verify audible/visual signals.	Weekly (unmanned) / Per shift (manned)
Batteries (VLA)	Check electrolyte levels and inspect for cell jar cracks.	Monthly
Batteries (VLA)	Measure and record individual cell float voltages.	Quarterly
Batteries (VLA)	Perform a full battery capacity (discharge) test.	Every 5 years*
Circuit Breakers	Infrared (IR) scan and thermal analysis.	Annually
Circuit Breakers	Manual operation of critical Molded Case Circuit Breakers (MCCBs).	3 years (outdoor) / 6 years (indoor)
Transformers	Dissolved Gas Analysis (DGA) for oil-filled units.	Annually
Transformers	Electrical testing of bushings (capacitance and power factor).	Every 3 to 6 years
Protective Relays	Functional testing and input/output verification (Microprocessor type).	Every 2 years
Protective Relays	Calibration and functional testing (Electromechanical type).	Every 1 to 2 years
Fire Systems	Inspect portable fire extinguishers and check tamper seals.	Monthly
Emergency Power	Exercise engine generator for a minimum of 30 minutes.	Monthly
Test Equipment	Calibrate battery voltmeters and IR cameras (NIST traceable).	Annually

*\*Note: Battery capacity testing increases to annually if the capacity falls below 90% of the manufacturer's rating.*

## References

Bureau of Reclamation. (2020). *Maintenance Scheduling for Electrical Equipment* [Report]. [https://www.usbr.gov/power/data/fist/FIST\\_4-1B\\_\(7-2020\).pdf](https://www.usbr.gov/power/data/fist/FIST_4-1B_(7-2020).pdf)