

# The Benefits of a Preventive Maintenance Service Plan for Your UPS



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Implementing a preventive maintenance service plan for your UPS is much like completing routine repairs and inspections on your vehicle. Not only is completing scheduled maintenance recommended by every auto manufacturer, but the findings can help detect a wide range of ailments under the hood *before* they become serious issues. In the same way that analyzing pressure and fluid levels, checking the alignment, and inspecting the brake pads at specified mileage intervals can maintain performance and factory specifications for your vehicle, preventive maintenance helps ensure the ongoing integrity of your UPS. After all, it is much more palatable to tweak the alignment at the first sign of needed adjustment as opposed to finding out down the road that you now need four new tires—not to mention the original alignment that likely would have preserved the tires in the first place.

A variety of different UPS service options are available including routine scheduled maintenance, emergency parts and labor service, and other value-added offerings such as remote monitoring capabilities. Regardless of the exact course of action you choose, an effective preventive maintenance plan will save time and money by minimizing business interruption and the costs of downtime as well as enhancing your overall return on investment by extending the lifespan of your critical power equipment. Preventive maintenance is also crucial to achieving maximum performance from your equipment by affording the opportunity to detect and repair potential problems before they become significant and costly issues, thereby minimizing the risk of unplanned downtime.

## Downtime is disastrous

No matter how you assess it, downtime carries an enormous price tag. Electric Power Research Institute (EPRI) estimates the national cost of power interruptions at approximately \$80 billion per year to U.S. electrical customers, with momentary interruptions accounting for two-thirds of the total cost at \$52 billion. The U.S. economy loses between \$104 billion and \$164 billion to outages each year, and another \$15 billion to \$24 billion to power quality issues. Furthermore, the annual downtime average for the utility grid in the U.S. is currently eight hours and 45 minutes. However, with on-site generation equipment and UPS solutions, this downtime can be reduced to the equivalent of five minutes and 15 seconds per year.

## What are the root causes of downtime?

It may come as a surprise that more than two-thirds of downtime events stem from preventable causes, according to the 2007 Study of Root Causes of Load Losses compiled by Eaton Corporation. Studies have also shown that approximately four percent of UPS failures are the result of components wearing out due to age, while up to 20 percent fail due to bad batteries. Studies into the causes of downtime reveal that:

Preventable downtime (67%) is caused by:

- Human error
- Lack of process
- Incorrect procedures
- Poor design
- Inadequate redundancy
- Insufficient maintenance

Nonpreventable downtime (33%) is caused by:

- Equipment failure (despite proper maintenance and testing)
- Supply chain/service chain failure
- Cyber terrorism

The positive news is that routine preventive maintenance appreciably reduces the likelihood that a UPS will succumb to downtime. In fact, the same load loss report revealed that customers without preventive mainte-

nance visits were almost four times more likely to experience a UPS failure than those who complete the recommended two preventive maintenance visits per year. These findings validate the significance of regular UPS service as a highly effective means to reduce the potentially devastating effects of downtime.

## What is your risk of UPS failure?

Because all manufacturers' UPSs are complex devices that perform several critical power conditioning and backup supply functions, they are all subject to failure. However, by implementing a comprehensive preventive maintenance service plan that is delivered by trained and certified technicians, you can significantly reduce your vulnerability to a load loss and extend the life span of your UPS.

As Chart 1 illustrates, routine preventive maintenance significantly reduces the probability of a load loss event. Through the completion of systematic inspections, a preventive maintenance plan ensures that the various electronic and mechanical components of a UPS are thoroughly evaluated, cleaned, tested, and calibrated on a regular basis. Without proper maintenance, many UPSs will fail prematurely since critical components such as batteries and capacitors wear out from normal use. However, a solid maintenance plan identifies issues and greatly reduces this risk of failure.

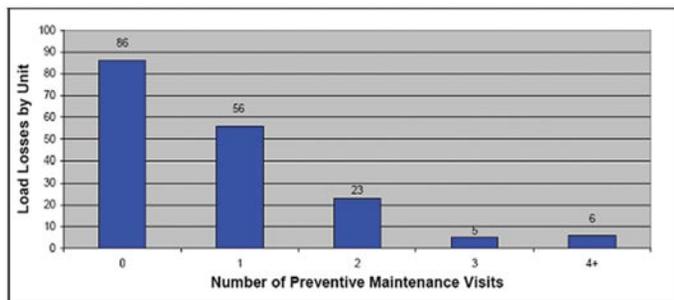


Chart 1 — Powerware UPS load losses by preventive maintenance visits delivered in prior year.

## Minimize interruption to your business

Lost or corrupted files, hardware malfunctions, the inability to access the critical systems you need - all of these unpleasant consequences (just a small sampling of the possible outcomes of unexpected downtime) can significantly impact your ability to conduct business, not to mention the potential for lost revenue and damaged reputation in the event that customer service mechanisms such as on-line ordering, phone systems, or other sales tools are unavailable to potential customers. In many instances, there is very little lag time between system downtime and financial disaster. However, with an effective preventive maintenance plan, your business will have access to more reliable, higher quality and more cost-effective power, all of which minimize the risks of downtime and disruption to your business.

## Outlining an effective preventive maintenance plan

There are a number of measures that are recommended to ensure the ongoing integrity of your UPS, including:

- Annual scheduled preventive maintenance for both the electronics and battery
- Access to rapid emergency response from trained technicians on the specific UPS models
- On-site parts inventory or local field technicians with van-stocked required parts
- Access to technical support and design engineering resources during escalation
- Remote monitoring with monthly trended reporting, 7x24 alarm notification and rapid response linkage to field technician
- Adherence to recommended parts replacement cycles, especially items that wear out more quickly such as batteries and capacitors
- Understanding of the UPS life cycle, expansion features, and total cost of ownership
- Access to 7x24 call center specialists and local technicians
- Maintaining accurate records

Furthermore, since most VRLA batteries wear out every three to five years, it is critical that they are regularly inspected. And, considering the fact that the failure of a single battery jar can cause an entire UPS to fail, battery testing and replacement as needed are a fundamental component of a proper UPS maintenance plan, with most customers opting for semiannual VRLA or quarterly wet cell battery preventive maintenance. A new trend in battery and UPS maintenance plans is to deploy a battery monitoring system to constantly measure and report if any individual battery is out of factory specification. By allowing a qualified service provider to remotely monitor battery systems, businesses gain peace of mind knowing that expert eyes are watching and interpreting data round-the-clock.

## Typical maintenance replacement cycles

The following guidelines will help you determine the optimal replacement period for various UPS components:

### Battery Life

Standby use: Three to five years for VRLA batteries, wet cell battery; life is variable.

Cycle use: 1200 cycles at 30% of discharge, 550 cycles at 50% of discharge, 250 cycles at 100% of discharge.

Capacitors: Inspect annually. Replace every seven years or as needed.

### Hot-Swappable

Fans: Replaceable with unit online if redundant or on bypass. Verify annually; replace every seven years.

Lug terminals: Crimp any mechanical power lugs, annual visual and thermal inspection.

Air Filters: Replace annually or as needed.

## Common UPS tests to optimize availability

The most successful UPS installations, which are measured by system availability or uptime, include prescriptive maintenance programs that are rigorously enforced. Within an effective maintenance strategy are a number of functional tests and component checks that should be conducted regularly. Specifically, an operational test or major preventive maintenance event, which cycles the UPS through its various change-of-state modes, should be conducted while monitoring key operating parameters such as voltage, frequency, current, and temperature. The following operational tests are typical:

1. **Transfer to bypass and return to UPS:** This test checks the static switch and bypass breaker motor operator or contactor. The test interval should be at least annually and can be performed with the load on maintenance bypass.
2. **Battery operation and return:** Sometimes coupled with a transfer-to-generator support and return to normal, this test is typically performed monthly and tests the UPS, generator, and automatic transfer switch (ATS) functions.

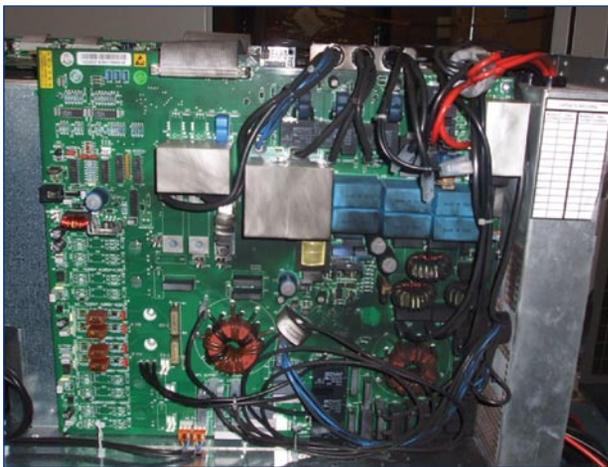


Photo 1—UPS failure due to the ingress of conductive, foreign material



Photo 2—Random component failure

3. **Load balancing evaluation:** This test checks for loads on any phase that may be approaching 100 percent. To limit potential overloads, loads may be redistributed as necessary. It is important to note that any one phase may be overloaded and trigger an unexpected alarm or transfer even if the other two phases are only lightly loaded.
4. **Phase rotation/site wiring checks:** This test inspects for out-of-limit bypass alarms or site wiring faults that may have occurred as a result of normal site wiring changes or maintenance. These problems can go undetected until a transfer to bypass is attempted.
5. **Listening tests:** An experienced technician should listen for abnormal operational sounds, particularly arcing, fan-bearing noise, or synchronization problems, including hunting sounds or beat frequencies. These subtle hints can easily go unnoticed by users unfamiliar with the warning sounds.
6. **Operator refresher training:** Since most power interruptions are a result of human error, constant attention should be paid to ensuring and documenting that all personnel with access to the UPS and associated switchgear have a solid understanding of the operation of the system and the consequences of any incorrect actions.

## Conclusion

Every UPS contains life-limited components that must be replaced according to the manufacturer's specifications. To ensure these parts are properly cared for and replaced when needed, regular maintenance is critical.

An effective preventive maintenance strategy can be one of the most cost-effective measures you can take to ensure the ongoing health of both your critical equipment and your overall business. Because regular maintenance practices so dramatically improve the UPS reliability and performance, while notably deterring downtime, preventive maintenance is an essential component of an end-to-end solution to keep your critical networks operating at peak performance in the face of multiple threats. 🌐

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