



UPS MAINTENANCE FOR RELIABLE POWER

Downtime Is Expensive, Peace of Mind Is Priceless

Abstract

Periodic and proper UPS Maintenance increases reliability of UPS systems and reduces the risk of an unscheduled downtime.

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An Uninterruptable Power Supply (UPS) System is a REQUIRED piece of equipment in Critical Power Applications. UPS systems provide reliable power for data center computers and servers, medical equipment, utilities, broadband services, telecommunications and industrial applications.



No matter how large or small your organization is, you really can't survive without the availability of clean and uninterrupted electrical power. Loss of commercial power is probably the number-one concern of most data centers, facility managers and IT directors, which is why it is very important to maintain and protect all

your mission critical equipment.

Besides providing backup electricity in event of a utility power outage, UPS systems condition the power to ensure it is clean, constant and does not have voltage spikes. The importance of a reliable supply of electricity is often overlooked and if a computer is not receiving a constant and clean flow of power, damage can and often does occur.

The average cost of downtime is \$9000 per minute but the cost can be much higher.ⁱ You are protecting a significant investment in information technology and communications for your organization – downtime is just not an option. To ensure the UPS systems are reliable, periodic maintenance must be performed to verify proper power conditioning and mitigate potential failures. An analysis of the number of PMs to UPS failures concluded that an increase in the number of PMs had a true correlation to an increase in the Mean Time Between Failures (MTBF). The analysis determined that at least 2 PMs per year will have a positive impact on the MTBFⁱⁱ.

What does a UPS System Consist of?

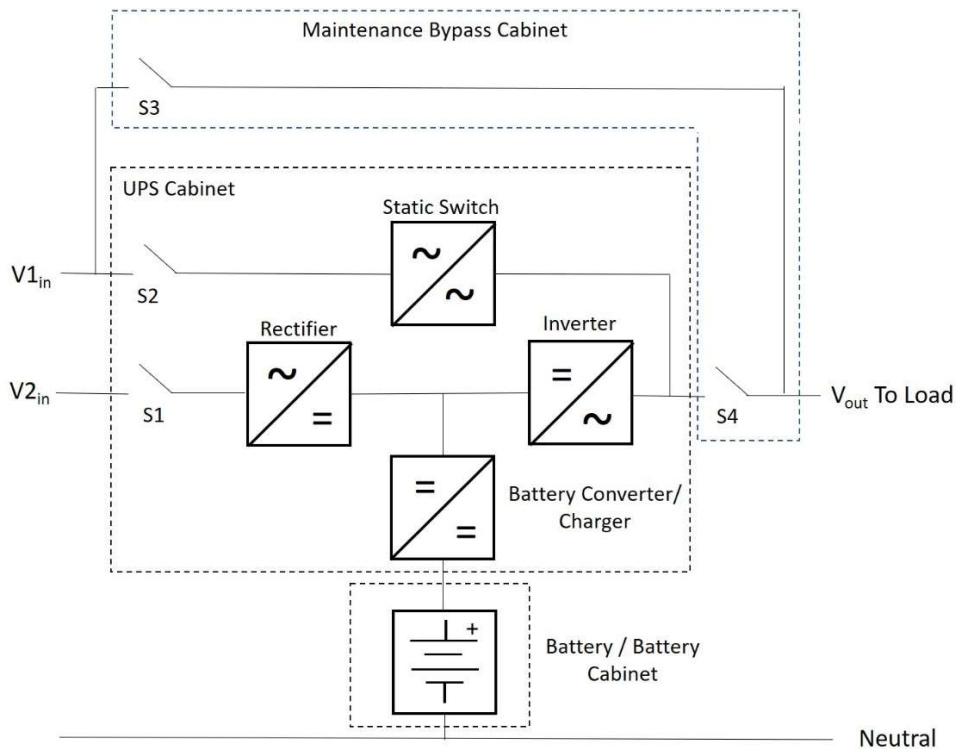
A UPS system is an electrical apparatus that provides emergency power to a load when the input power source, typically utility power, fails. A UPS protects equipment from such elements as power interruptions, voltage variations, frequency variations and transient disturbances. A UPS differs from auxiliary or emergency power systems or standby generator in that it will provide instantaneous or near-instantaneous protection. This means that the load does not see any interruptions in the power.



As technology advances, more pieces of equipment require uninterruptible power, making a reliable UPS increasingly crucial in any facility. Upon losing utility power to a facility, it often can take 10 seconds or more for the generators to start and begin carrying the load. Most electronic

equipment will not tolerate more than a few cycles of power disruption without shutting down. A UPS system is typically utilized to bridge the power while the generator starts up preventing the load from losing power.

Minimizing disruptions to the power source starts during the power system’s design phase. A reliable power system depends on quality equipment and reliable design. A facility’s UPS should be designed to protect critical and high-tech equipment and to facilitate planned power outages to enable technicians to perform maintenance without interrupting the power to the load. A typical UPS system consists of: the UPS Cabinet, Battery, Maintenance Bypass Panel (MBP) and Output Power Distribution as illustrated in the one-line below.



The UPS cabinet consists of the Rectifier, Inverter, Battery Converter and Static Switch. Some smaller power UPS will include the battery in the same cabinet. The rectifier converts AC voltage to DC voltage which is used to charge the batteries and provide power to the inverter which converts the DC voltage to AC voltage. This is called double conversion. The advantage of double conversion (with high efficiency inverters) is the creation of clean power. The Static Switch senses problems with UPS systems and automatically connects the load to the primary or a secondary power source while bypassing the rectifier, inverter and batteries.

The MBP provides the ability to work on the UPS while retaining power to the load. This is accomplished through a set of breakers which switch load directly to the utility power bypassing the UPS and retaining power to the load. Battery systems can be either Valve Regulated Lead Acid (VRLA) or Vented Lead Acid (VLA) type batteries installed in a cabinet or open rack.

The Importance of UPS Maintenance



Preventative Maintenance (PM) is crucial to maintaining and protecting the integrity and lifetime of the UPS and battery system. PMs provide insight to potentially weak links or components within the UPS. Depending on uptime requirements, UPS maintenance may be performed quarterly, semi-annually or annually. Some of the key failure areas are electronic circuit boards, AC capacitors, DC capacitors, cooling fans and more. Checking these components during routine maintenance and replacing potentially failing parts reduces the risk of UPS failure. Stated another way, PMs increase system uptime.

Each UPS is different and have different recommended parts replacement times which makes it critical that the maintenance be performed by a qualified and experienced technician familiar with the brand and model UPS. Inherent failures of UPS systems vary from one manufacturer to another. Failure rates can depend on the age of the UPS and the technology generation of the UPS. Today's UPS systems provide much cleaner power and increased reliability. However, no matter how new or old a UPS system is, the PM is the only way to have confidence in the operation and reliability of a UPS when it is needed.

A good PM program includes:

- Thorough electrical and visual check of UPS components
- Knowledge of high failure components based on UPS Mfg., model and age of system
- Battery system analysis using approved test equipment
- PM schedule based on reliability needs and critical environment
- Documentation and review for trends
- Recommendations of repair of identified components that may fail short term
- Follow IEEE Standards for testing and maintenance of UPS and Battery systems



The Importance of Battery Maintenance



The picture to the left is an example of a UPS battery that went into Thermal Runaway. Hydrogen gas built up inside the battery along with high temperature causing the case to bulge. There is a real danger of a hydrogen gas explosion when this occurs. This could have been prevented with proper battery checks. A reliable and fully operational UPS system depends exclusively on the correct maintenance of the system. The battery is the most vulnerable component of any UPS system, regardless of brand or capacity. Battery failure is a leading cause of load loss, understanding how to properly maintain and manage UPS batteries can help prevent costly downtime. You can't afford to wait for problems to arise before taking action.

Battery PMs are crucial to maintaining and protecting the integrity and lifetime of the battery. During the PM, technicians utilize specialized battery analyzers and test equipment that provides critical measurement data on the battery condition. This data is interpreted to enable insight to batteries that may be on the verge of failing. A baseline is established for a battery system during the first PM. This baseline is utilized during subsequent maintenance to identify cells that are changing their inherent characteristics and potentially failing.

The Institute for Electrical and Electronics Engineers (IEEE) provides standards-driven recommendations for battery maintenance procedures.ⁱⁱⁱ Following the industry best practices along with the IEEE standard offers the best way diagnose potential failures.

The Benefits of Having a Service Contract

A typical UPS and battery service contract includes scheduled preventive maintenance visits, your choice of annual, semi-annual or quarterly. It may also include guaranteed 4-hour response time, 7x24 emergency response coverage and may have all parts, travel and labor included. Without a service contract in place maintenance and repairs can become exceedingly costly. With a service contract, the servicing vendor typically schedule the PMs in advance. There is little chance that a PM will be missed if you didn't remember or were too busy to schedule it.

The benefits of a good maintenance contract include:

- Reduced risk of Unscheduled Downtime
- Ease in budgeting with fixed price contracts
- Choices of response times to meet budget and uptime requirements
- Ability to schedule maintenance at convenient times
- Emergency Response Service Calls Available
- Reduced Time and Material labor rates for contracted sites
- Early warning of potential parts and battery failures
- 24/7 Technical Support



Select a maintenance provider knowledgeable about your brand of UPS, has many years of experience, can quickly repair failing systems and that offers a maintenance program to meet your needs and budget. Most important select a maintenance plan that offers the most benefits for your site.

In any case, if you are responsible for a mission critical facility that requires essential power and cannot be a risk of the power being down, be sure your UPS is on a scheduled maintenance program.

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About Lorbel Inc.

Lorbel Inc. was created by engineers with over 26 years of experience years in power quality and management. The company was established in 2008 by a critical power industry veteran who saw the opportunity to put together a team of technicians to bring high-quality service to customers throughout California.

In 2014 Lorbel extended its services by acquiring its electrical license. Lorbel is also able to provide infrared scanning to help its customers with their everyday power needs at a low risk, cost- effective price.

As of today, Lorbel has opened two corporate offices located in Rancho Cucamonga, CA and Las Vegas, NV. It is a national service provider for many companies, such as Switch Communications, Charter Communications, Toshiba, Coherent, Boeing and much more. As an independent service provider, Lorbel provides turn-key solutions in the mission critical industry and can structure a plan that caters to all your critical power demands.

Service Plans

Lorbel offers serve and maintenance plans for your critical power and cooling equipment to maximize uptime and control lifecycle costs. Different service levels and response times are available, allowing you to choose the tight plan to meet your specific uptime requirements.

Plan Coverage Service	Standard Plus ¹	Premium ¹	Ultra ²
Preventative Maintenance Inspections 8am – 5pm, Mon.-Fri.	X	X	X
Preventative Maintenance Inspections 24/7			X
24/7 technical support and emergency response	X	X	X
Service inspection report within 72 hours of service	X	X	X
15 minute emergency call back	X	X	X
24 hour emergency on-site response ³	X		
4-8 hour emergency on-site response ³		X	X
Parts, travel and emergency labor for remedial repairs included			X

Notes:

1. Emergency travel/labor, party, batteries, main transformers, and capacitor banks are NOT included and are subject to a separate quote and billable at LORBEL’s standard Time & Materials rate.
2. Batteries, main transformers, and capacitor banks are NOT included and are subject to a separate quote and billable at LORBEL’s standard Time & Materials rate.
3. Response time is based on geographical location.



ⁱ "St Laurent, Jesse. Data Center Dynamics Paper. *The True Cost of Downtime*, October 10, 2016."

<http://www.datacenterdynamics.com/content-tracks/security-risk/the-true-cost-of-downtime/97089.fullarticle>

ⁱⁱ "White Paper, WP153-117, *The Effect of Regular, Skilled Preventive Maintenance on Critical Power System Reliability*. Emerson Network Power, 11/07"

ⁱⁱⁱ "Vahlstrom, Wally. Director Technical Services, Emerson Network Power, Electrical Reliability Services. *Required or Recommended: Understanding Battery Maintenance Standards for Critical System Protection*". Battery Power Magazine." <http://www.batterypoweronline.com/blogs/required-or-recommended-understanding-battery-maintenance-standards-for-critical-system-protection/>

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