Single-Phase UPS Maintenance and Service

Best Practices for Maintaining and Managing Single-Phase UPS Equipment

EXECUTIVE SUMMARY:

Single-phase UPS equipment has a useful life ranging from six to ten years depending on the size and topology of the UPS. Properly maintaining your equipment will have a direct impact on the length of reliable service your UPS equipment can provide. Actively managing and maintaining large fleets of single-phase UPS equipment is imperative to maximize uptime and lower operational expenses. Learn best practices to prolong the useful life of your UPS equipment and simplify fleet management while maximizing uptime.

Single-Phase UPS equipment is often installed, set-up, and then quickly forgotten – until it fails. Depending upon the topology, a single-phase UPS can fail and drop the load for reasons that can range from a bad battery to a failed power module.

Sites with a UPS Fleet Management Plan have a significantly reduced risk of downtime caused by a single-phase UPS failure.

Keeping track of single-phase UPS equipment installed throughout your site or sites can be a challenge as fleet deployments grow or IT personnel changes. Without an actionable fleet management plan, the risk of downtime increases dramatically.

In this whitepaper, we will discuss best practices for maintenance and service for single-phase UPS equipment and fleet management strategies to help IT managers keep track of deployed equipment, warranty and service plan coverage, and upcoming maintenance or UPS replacement needs.

SELECTING THE RIGHT SINGLE-PHASE UPS FOR YOUR APPLICATION

Line Interactive Versus Double-Conversion Online

Before discussing the maintenance schedule for various types of single-phase UPS equipment, it is important to understand the difference between the two most popular topologies available on the market – Line Interactive and Double-Conversion Online. With a basic understanding of the topologies, their applications, and the maintenance recommended to maximize the life of the UPS, it is easier to select the correct UPS for your requirement.

One of the first things to consider when selecting a single-phase UPS is which topology is best. Without getting into a technical discussion about how each topology works; in layman's terms, the primary feature difference in single-phase UPS equipment is the internal bypass. Double-Conversion Online topologies have an internal bypass while less expensive Line Interactive UPS equipment does not.

The primary benefit of having an internal bypass is to prevent the UPS from shutting down in the event of a problem. In the absence of an internal bypass, when the UPS detects a problem, such as a failed battery, the UPS will shut down resulting in losing power to the IT load it is protecting. When an internal bypass is present, the UPS will transfer the load to utility power instead of simply shutting down, maintaining power to the load.

Line Interactive UPS equipment will drop the load when there is a battery failure, where a double-conversion online UPS will switch over to utility power keeping your critical load powered.

With that being the case, Power Solutions recommends that double-conversion online UPS equipment is used exclusively for highly critical applications. In almost all cases, double-conversion online UPSs are more expensive than their line interactive counterparts. It's worth noting that larger single-phase UPS models, regardless of manufacturer, are generally double-conversion online. Line interactive topologies are most commonly found in smaller plug-and-play models under 5kVA.

SINGLE-PHASE UPS LIFECYCLE

The useful service life of a single-phase UPS depends on size and topology

The major UPS manufacturers have differing guidelines for the recommended lifecycle of single-phase UPS equipment. The useful life of a single-phase UPS depends on power rating, topology, installation environment and maintenance schedule. There is a huge range of single-phase UPSs for a variety of applications and environments, so to keep the discussion simple, we will use the following rule of thumb:

- Small, plug-and-play UPSs up to 5kVA have a useful service life of 6 years
- Larger, hardwired UPSs 5kVA and up have a useful service life of 10 years

At Power Solutions, we recommend factory warranty and service coverage for all UPS equipment. We Also suggest our customers follow a UPS replacement schedule that matches the manufacturer's useful service lifecycle. In many cases, manufacturers will not offer factory warranty extensions or service plans past the pre-determined useful service life for a particular model UPS. Since many organizations don't want to risk a lack of factory warranty or service support, that

means most sites should plan to replace smaller UPS equipment every 6 years and larger, hardwired UPS units every 10 years. There are some exceptions to this when modernization services are available. Those options will be discussed in a later section of this whitepaper.

MAINTENANCE FOR PLUG-AND-PLAY UPS EQUIPMENT UP TO 5kVA

Smaller UPS equipment with an input cord and output receptacles

By plug-and-play, we are referring to single-phase UPS equipment that has an input plug and output receptacles to directly plug in the equipment the UPS is going to protect. These smaller units are generally less expensive, and the major manufacturers recommend replacement every 6 years.

Almost all Single-Phase UPS equipment is designed with user-replaceable battery modules.

The most likely components to fail in a small single-phase UPS are the batteries followed by the fans. While a fan replacement can be costly depending on the UPS make and model, almost all small single-phase UPSs are designed with user-replaceable battery modules. We recommend replacing the batteries after 3 years of service. For UPS equipment that is installed in warmer environments, such as poorly ventilated network closets, users may consider replacing the batteries every 2 years depending on the topology of the UPS.

It's worth noting that for the purposes of this whitepaper, battery replacement timelines are based on common recommendations for UPS equipment with lead acid batteries. Lead acid is the most common battery chemistry on the market today. However, all the major UPS manufacturers are expanding their single-phase UPS offer to include Lithium-Ion (Li-ion) batteries. Li-ion batteries have a different maintenance and replacement timeline and will be discussed in another whitepaper.

Most Single-Phase UPS equipment comes standard with a 2-year repair or replace factory warranty. This means that, in the event there is a problem with the UPS or battery, the factory will either send replacement parts or a completely new UPS. The warranty does not include any labor.

Factory warranty extensions are available from most major UPS manufacturers. In general, these are less expensive when purchased with the equipment, but are still available for purchase on an annual renewal basis provided the next year's warranty is purchased prior to the current warranty expiration. As mentioned previously, the UPS manufacturers have a pre-determined maximum service life for single-phase UPS equipment, and they will not renew warranty extensions past that point.

Smaller UPS equipment is relatively maintenance – free but still requires a battery replacement after 3 years and total replacement after 6 years

Smaller plug-and-play UPS equipment installed in temperature-controlled environments are relatively maintenance-free, requiring a battery replacement around year 3 and then total unit replacement around year 6. We do recommend connecting equipment installed in remote areas of the site or in branch offices to the network so IT personnel can receive alarms and notifications from the UPS in the event that a problem occurs.

MAINTENANCE FOR LARGER, HARDWIRED UPS EQUIPMENT 5kVA AND UP

Hardwired input and output, often 208V

Most major UPS manufacturers consider their larger single-phase UPS equipment to have a service life of 10 years. Like their smaller counter-parts, single-phase UPSs 5kVA and up generally come with a 2-year repair or replace factory warranty. In many cases, modular UPSs will have an upgrade available to add onsite service during the warranty period. This means that if a power module fails, for example, instead of simply shipping the new part to the site, the manufacturer will also send a factory technician to replace the part. Response upgrades are usually also available depending on the geographic location of the equipment and the service coverage the manufacturer has in the area.

Because larger, hardwired UPSs are more complex, the manufacturers often require a factory start-up service to confirm proper installation prior to initiating the factory warranty. This is especially true of modular UPSs and units that are over 8kVA. The start-up service needs to be purchased at the same time as the equipment.

Warranty extensions are also available for larger, hardwired UPS equipment, but in many cases, these warranty extensions are only available for 5-6 years after the initial installation. After that point, a more comprehensive factory service plan is required by the manufacturer. These service plans usually include both parts and labor in the event of a problem and usually include coverage of the batteries.

In most cases, complete proactive battery replacement services are not included in factory service plans so this is an additional expense that will need to be planned for.

It's important to note that factory warranties and service plans typically include coverage for the UPS batteries only when they fail. These service plans do not cover proactive replacement of the UPS batteries. This is an additional cost that should be budgeted for.

Just like with small UPS equipment, Power Solutions recommends connecting larger single-phase UPSs to the network to allow notifications of alarms. In larger installations, a DCIM or Data Center Infrastructure Management software solution is preferred to add some remote management capabilities.

As previously mentioned, the typical useful lifespan for larger single-phase UPS equipment is 10 years. Some manufacturers offer modernization services to allow customers to extend that to as much as 13 years. The services available vary greatly depending upon the manufacturer and the model UPS. There can also be age restrictions imposed by the manufacturer.

Below is a timeline of the typical maintenance schedule for a 12kVA Modular UPS.

Year 0-2 After Installation	Year 3-8 After Installation	Year 8-10 After Installation
Factory Assembly and Start-Up Service Standard Factory Warranty with available onsite labor and response upgrades *Optional – pre-purchase factory extended warranty coverage for years 3-5*	Factory Warranty Extension *(up to year 5 and only if purchased with equipment)* Or Comprehensive Factory Onsite Service Plan **1st Complete Battery Replacement Service by end of Year 4**	Comprehensive Factory Onsite Service Plan **2nd Complete Battery Replacement Service** *Optional - Modernization Services to refresh power modules** Plan for UPS Replacement at Year 10 Or Year 13 if modernization services have been completed

*For additional detail on Modernization Services, please refer to the section below titled, "Special Considerations for Modular UPS Equipment"

MANAGING MULTIPLE SINGLE-PHASE UPS UNITS

Fleet Management options for larger deployments

While the recommended maintenance and service tasks for smaller plug-and-play UPS equipment are fairly simple, managing an entire fleet of small UPS units with differing vintages can get complicated quickly. Add in some larger single-phase UPS equipment with a more varied maintenance and service schedule and it is easy for IT professionals to start to lose track of what needs to be done when and for which unit.

Some users track battery replacement schedules, warranty renewal dates, and equipment end of life dates in a spreadsheet. Others use DCIM solutions to manage their fleet of UPS equipment; while others hire that responsibility out to IT service companies. Regardless of which is right for your organization, it is important to keep track of each UPS, its status, and the next maintenance or service due. This not only helps IT managers ensure 100% uptime, it helps with budgeting and planning.

It's likely that most organizations already have an install base of single-phase UPS equipment. The current fleet may include equipment from different manufacturers, different vintages, various models, and a variety of operational statuses. What's the best way to get a handle on the status of the current fleet of UPS equipment?

Keeping track of UPS status and maintenance with a fleet management plan not only ensures uptime but helps with budgeting and planning.

Power Solutions recommends that sites standardize on a single UPS manufacturer and, in some cases, a particular product family offered by a specific manufacturer. Each site has their own specific needs, so the manufacturer and product family best suited for your organization depends on several factors such as application, runtime requirements, location, brand preference, and required accessories. So how do you decide?

Power Solutions offers site audit services where we help customers gather make/model and serial number data on current equipment. We can even check the battery status, measure the temperature and humidity in the room the UPS is located in, and confirm the UPS is connected to the network. Armed with this detail, Power Solutions can help develop a fleet management plan with specific recommendations to optimize your fleet of UPS equipment in a timeframe that makes sense for your budget.

Depending on the overall health of the current UPS fleet, it may take a year or more to get the entire UPS fleet optimized, but with a plan in place, annual budgeting is simplified, and operational expenses become more predictable; all while decreasing the chance of downtime caused by an unexpected UPS failure.

PLANNING FOR UPS UPGRADES AND REPLACEMENT

Mitigate the cost of upgrading your UPS fleet with a phased roll-out

It's not uncommon to review the current status of your fleet of single-phase UPS equipment and decide that it's time to upgrade or replace a large portion of the fleet. This is particularly true for sites that haven't maintained a fleet management plan and/or have had a lot of turnover in IT personnel. Institutional knowledge of the overall UPS deployment can get lost when certain people change roles or leave the company.

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Many customers elect to replace or upgrade their fleet of single-phase UPS equipment with a phased roll-out approach. Once a fleet assessment is completed and there is a good understanding of the location, status, and age of the UPS equipment installed throughout your organization, it's time to prioritize action items. Which units require immediate replacement? Which need new batteries? Are they all connected to the network? Can they be? Are all of the UPSs the appropriate topology? Best practice suggests double-conversion online for network and highly critical applications while the less expensive line interactive topology can be appropriate for less critical applications.

- *Which UPS units need immediate replacement?*
- *Which need new batteries?*
- *Is every UPS connected to the network?*
- *Those that aren't, can they be?*
- *Is it time to consider a DCIM solution?*
- *Are all of the UPS units the appropriate topology?*
- *Which are in the most critical applications?*

When it is time to replace aging UPS equipment, many customers take the opportunity to upgrade to UPS equipment that has network connectivity or to units that are double-conversion online with an internal bypass. It's also a good time to review the runtime requirement and add external battery packs, if required.

Pro Tip: Most major UPS manufacturers require new single-phase UPS equipment to be registered in order to initiate the factory warranty. This is generally done online and can be completed by following the instructions provided with the UPS manuals.

Pro Tip: Many UPS manufacturer partners, like Power Solutions, can offer discounts on volume purchases of single-phase UPS equipment. Consider buying your replacement equipment in batches to take advantage of the available discounts.

Worth Considering: When starting a single-phase UPS fleet upgrade, it is a good time to look at the entire power and cooling infrastructure as a whole. Is it time to add a DCIM solution to help monitor and manage all the UPS equipment on site? Sometimes, we stick with what we know – such as managing assets on a spreadsheet and as the site grows, the spreadsheet gets increasingly more

complex significantly increasing the chance for human error.

SPECIAL CONSIDERATIONS FOR MODULAR UPS EQUIPMENT

Extend the useful life of modular UPS Systems with a Power Revitalization Service

Manufacturers such as Schneider Electric offer a Modular Power Revitalization Service (MPRS) for modular UPS equipment. With the MPRS, all the internal components of the UPS are replaced including power modules, intelligence modules, fans, and displays. Essentially, everything except the chassis is replaced. This leaves you with brand new UPS equipment at a fraction of the cost to replace it.

Also, instead of being powered down, the UPS only needs to go into bypass to complete the MPRS. This virtually eliminates the need for downtime to upgrade the UPS protection and avoids electrical installation costs.

The Modular Power Revitalization Service is ideal for systems in years 8-10 of their service life. For best results, it is recommended that the batteries be replaced at the same time. Customers that have this refresh service completed can expect 3 or more years of reliable service life from their UPS.

WHY FACTORY SERVICE?

Peace of mind knowing that only experts are working on your equipment

Factory certified technicians generally train with the manufacturer's product developers giving the technicians the highest level of system knowledge and ensuring that they are familiar with all product upgrades. Factory trained technicians have to recertify with the manufacturer on a regular basis so their skills and product knowledge remain sharp. This enables them to quickly troubleshoot and accurately diagnose system issues resulting in shorter repair times, minimal downtime, and optimal system performance.

Additionally, the major manufacturers train and support a national and sometime global network of trained technicians so you can have access to factory service when and where you need it. Along the same lines, the major manufacturers give customers with factory service plans supply chain preference so parts that can have lengthy lead times are almost immediately available through a network of

distribution centers. Third party service providers have to purchase their spare parts through traditional channels, which generally have longer lead times - and that translates to increased downtime for your equipment.

UPS and cooling equipment manufacturers frequently release software updates, engineering revisions, and firmware upgrades for their equipment. Usually, these updates are not available to third parties. Using only factory services ensures that your equipment has the latest upgrades available to maximize efficiency and the length of useful service life.

Factory trained technicians have to recertify with the manufacturer on a regular basis so their skills and product knowledge remain sharp.

Finally, many third-party providers specialize in one specific area of the data center so your UPS service provider may not be knowledgeable in maintenance and service for your cooling equipment or vice versa. The larger, global manufacturers such as Schneider Electric can service and repair your power and cooling equipment in addition to your switchgear, generator, and other power systems engineering equipment making them a true single source provider for your data center infrastructure.

CONCLUSION

Factory service offers hassle-free system maintenance at a predictable cost

In many ways, single-phase UPS equipment is the hidden workhorse for your organization. Networking equipment, point of sale terminals, local workstations, healthcare imaging and treatment equipment, campus safety infrastructure and small servers are often supported with distributed single-phase UPS equipment. If a failure were to occur, network communications can stop, transactions can't be completed, patient treatment gets interrupted, students aren't safe and data processes come to a halt.

Organizations cannot afford that kind of downtime. Properly maintaining and updating the fleet of single-phase UPS equipment is as critical to any organization as maintaining uptime for the primary data center UPS.

With extended factory warranties, comprehensive factory service plans, regular battery replacements, and modernization services, organizations can keep single-phase UPS equipment running and maximize uptime.

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Keeping track of single-phase UPS equipment installed throughout your site can be a challenge as fleet deployments grow or personnel changes. Without an actionable fleet management plan, the risk of downtime increases dramatically. Fleet management services help customers manage their single-phase UPS equipment and predict year over year expenses.

At a predictable and fixed annual cost, factory service plans take the guesswork out of budgeting for maintenance or unexpected service charges and ultimately minimize your total cost of ownership. Plus, you'll have peace of mind knowing your UPS system has the best, most comprehensive service available.

For more details about factory service plans from the major UPS manufacturers, contact Power Solutions.
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