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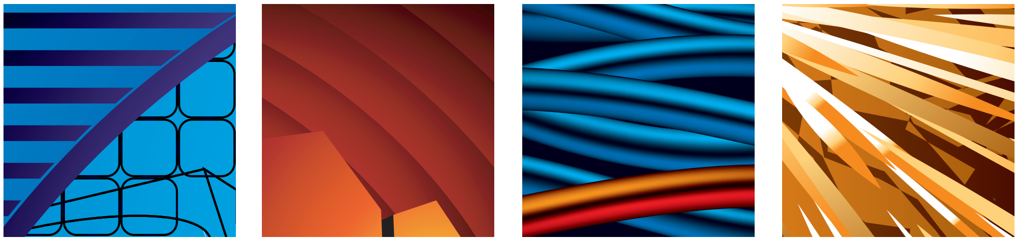

BY
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## 1 UNINTERRUPTIBLE POWER SUPPLIES: IMPLEMENTING A PROTECTION PLAN

When it comes to emergency-power systems, a technician's worst nightmare is silence. Imagine facing a sudden loss of utility power with no back-up generator. To ensure this nightmare does not come true, maintenance and engineering managers can specify uninterruptible power supplies (UPS), which are essential components of institutional and commercial facilities' strategies for protecting building operations and critical activities from power problems.

For a UPS to work properly and offer protection for a facility's critical equipment from power outages and related problems, managers need to implement a two-pronged protection plan: proper UPS selection and electrical-system design, combined with a comprehensive maintenance program.

### Testing and Maintenance

Frequent testing of UPS equipment helps identify problems and minimize potentially devastating power interruptions. In the past, a UPS was more difficult to test. For example, the system often would not provide notice of compromised battery capacity. As a result, technicians could not identify many potential equipment failures until the loss of utility power.

Today, many UPS are modular, which allows technicians to test or replace certain components of the unit while the UPS still provides full back-up for the designed duration to loads served. In other words, technicians now have no excuse for not testing and maintaining the UPS regularly.

## 2 A CHECKLIST FOR TESTING: MAINTAINING UNINTERRUPTIBLE POWER SUPPLIES

A UPS with a 100 percent charge does not mean much, except the batteries have been charged to their maximum capacity. Many UPS units require testing under load to determine whether the batteries have degraded over time.

The lifespan of UPS batteries is typically three-five years, depending on conditions and maintenance. At that time, technicians must replace them to ensure the unit operates properly. Keeping tabs on indicators of problems can ensure uninterrupted service to the equipment and facility operations, and, in many cases, a healthier bottom line.

Fortunately, many newer UPS have advanced monitoring systems that provide system status for such items as system voltage, battery back-up time, and battery test schedule. Other information the system monitors includes whether the UPS operates on batteries, utility power or maintenance bypass.

Many systems can remotely alert technicians if a problem occurs. This information can be especially helpful if technicians are not on site or monitor the facility remotely. Some UPS can even conduct a controlled shutdown for computers in a network upon receiving a low-battery warning.

Technicians also must test physical equipment quarterly, semi-annually, or annually using a specific checklist of items to cover. The schedule should include:

- Conducting visual inspections for wear and deterioration of battery and insulation components
- Cleaning and vacuuming the enclosure
- Monitoring the enclosure's temperature and humidity
- Performing thermal heat scans, which can indicate hot spots that often are the first sign of component failure
- Testing other electrical-system components, such as transfer switches, circuit breakers, and maintenance bypasses.

## 3 UPS REPLACEMENT: ANALYZE PAYBACK, LIFE-CYCLE COSTS

Two scenarios exist in which managers would need to replace a UPS. Either it has reached its load capacity, or a maintenance check has determined the batteries have reached their useful life and require replacement.

When it becomes apparent it is time to replace a unit, maintenance and engineering managers need to build a business case that analyzes both a simple payback and life-cycle costs. Providing both of these analyses will allow upper management to understand the financial impact and allocate funds for replacement. Managers can avoid providing maintenance and upgrades to old equipment by purchasing a newer technology unit that cuts labor costs and improves system reliability.

## 4 POWER MANAGEMENT: FOUR COMMON UPS TECHNOLOGIES

When the time comes to change a UPS, managers have a number of options from which to choose, and the choice will depend on the facility's current equipment and future needs. Managers need to carefully match the UPS with emergency-power-system schemes to assure the most reliable configuration possible.

**Common UPS technologies include:**

**Flywheel UPS**

The flywheel UPS is considered new-generation technology, but it has been on the market for the better part of a decade. If managers use a UPS in conjunction with a generator system, the flywheel might be a good option. It packs enough inertia to carry the critical loads through a power outage for a short period — normally 10-20 seconds — until the generator has started, stabilized, and picked up the required loads.

Typical applications include data centers, industrial, and health care facilities with a demand for high reliability. These UPS also are lighter, have smaller footprints and require less ventilation. As a result, they pose fewer structural, architectural, and mechanical challenges than traditional battery-powered units. These systems often have a higher initial cost, but with no batteries to maintain and other advantages noted previously, the 20-year life-cycle cost is relatively low.

**True Online UPS**

This type of UPS — sometimes referred to as double conversion or double-conversion online — provides a high level of reliability for large servers, data centers, and large, sensitive equipment. Under normal operation, it runs continually off the battery via the inverter, and the line power runs the battery charger. For a true online UPS, there is no transfer time upon the loss of utility power.

The system provides power-factor correction, frequency regulation, surge suppression, and power filtering. If the inverter fails — which is rare — the UPS will switch to power provided directly from utility power via the UPS power filter/ surge suppressor.

Managers should keep several considerations in mind with this type of UPS. Because the unit converts all power from alternating current (AC) to direct current (DC) and back to AC, low efficiency and high heat output can result.

One method to reduce this inefficiency is to replace the battery charger with a delta-conversion online UPS. In this scenario, instead of providing all output from the battery under normal circumstances, some of it comes directly from the delta converter from the input-line power. In the event of a power failure, the unit operates similar to a regular, true online UPS.

**Standby Online Hybrid**

This UPS — also sometimes referred to as double conversion on demand — is similar to a true online UPS but with higher energy efficiency. The significant difference is standby online hybrid UPS loads are served directly from utility power, as long as the power is within acceptable tolerances. Once the power exceeds set tolerances, the UPS switches to standard, true online operation. Typical applications include server rooms. These units come at a higher cost than other options but offer greater energy efficiency.

**Line-Interactive UPS**

This UPS continually conditions and regulates AC utility power to equipment via a power converter. If the utility power fails or falls outside the input range of the power converter, the UPS battery will support the loads via an inverter. The power converter filters the utility AC power, suppresses voltage spikes and regulates the voltage to provide the required power to equipment loads.

The central role of a UPS is providing power to crucial facility equipment and operations in an emergency. When a system is out of date, needs upgrading, or simply cannot perform its role properly, the best protection requires smart engineering design and appropriate equipment choices.

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