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Is TPPL Technology the Right Call for Your Telecom Stationary Battery Needs?

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Many situations fall into the "pay me now, or pay me later" dilemma. The challenge is to balance the up-front costs versus the long-term costs and performance issues. Telecom stationary battery applications are no exception.

Telecom Stationary Battery Challenges

Battery uses in the telecom market can range from temperature controlled wireline and wireless indoor applications, to uncontrolled wireline and wireless outdoor cabinets in extremely harsh and/or remote environments. Each location places different demands and stresses on the batteries being used, such as space requirements, environmental controls and extreme temperature operation.

Regardless of where they are used, systems designed to provide emergency backup in the event of a power failure are more than just "sit-and-wait" solutions. They involve selecting and designing the battery and control system with careful consideration for the characteristics and requirements of each unique operating environment.

Battery Options

Flooded batteries have traditionally been used to provide emergency backup power in telecom stationary battery applications because of their recognized reliability. However, their maintenance costs, susceptibility to environmental conditions and poor energy density, had left the market looking for alternative power sources.

The development of valve regulated lead-acid (VRLA) batteries promised to meet the market's need for a lighter weight, lower maintenance and more cost efficient battery solution. Unfortunately, many of the early VRLA batteries varied greatly in their quality of design and in their manufacture, and often the makers' claims exceeded the products' performance. Almost all VRLA batteries use traditional lead-calcium grids, which are inherently prone to corrosion. To accommodate for such corrosion and obtain an acceptable life, the grid thickness had to be increased. This reduced energy density and increased weight, and even so, the batteries rarely met the promised longevity. VRLA owners, dissatisfied with the batteries' life and reliability, turned to the evaluation of expensive and much more complex technology solutions such as fly-wheels, fuel-cells and lithium metal polymer batteries. These alternatives have worked in many applications, but recent developments have shown them to be costly and/or not as safe as originally anticipated.

Another option, more advanced VRLA batteries with thin-plate pure-lead (TPPL) technology emerged in the market more than 20 years ago, and has offered greater performance and reliability in both the laboratory and in field applications. In the past, many telecommunication network managers were unable to benefit from this TPPL technology because the larger batteries (greater than 100 ampere-hours) that are necessary for some types of telecom applications were unavailable. With recent advancements in the TPPL manufacturing technology, new 145 Ah, 170 Ah and 190 Ah products are now becoming available. These new models meet the power requirements of the majority of existing and new telecommunications applications and lets applications engineers take full advantage of TPPL advanced battery technology.

The Science Behind TPPL Performance

These TPPL batteries have proven to be ideal for telecom applications because they are a smaller, lighter solution with a longer shelf life, longer service life and a higher-rate of efficiency than traditional technologies. The enhanced performance of these batteries can be attributed to three main characteristics of TPPL technology:

Higher Energy Density: The thinner grid design in TPPL batteries is made possible by a patented process of cold rolled pure-lead grid manufacturing techniques. This process allows more plates to be packaged in the same space than with traditional book mold technology. Separating those thin plates with a porous micro-fiberglass separator and packing them tightly together provides mechanical support for the pure-lead grids and helps increase capacity because of better utilization of active material. The TPPL technology allows for more surface area within a battery, which creates a much more power dense environment that reduces the need for additional battery compartment space while maintaining a longer operational life.

Reduced Corrosion Effects: The chemical reaction in any lead-acid battery creates a potential for corrosion that can be accelerated at higher temperatures. A battery utilizing lead-alloy grids will suffer from corrosion more quickly than one using pure-lead technology. A pure-lead grid with minimal impurities features a more compact and smoother grain structure, which offers greater resistance to corrosion and enhances service life as well as shelf life (see Figure 1).

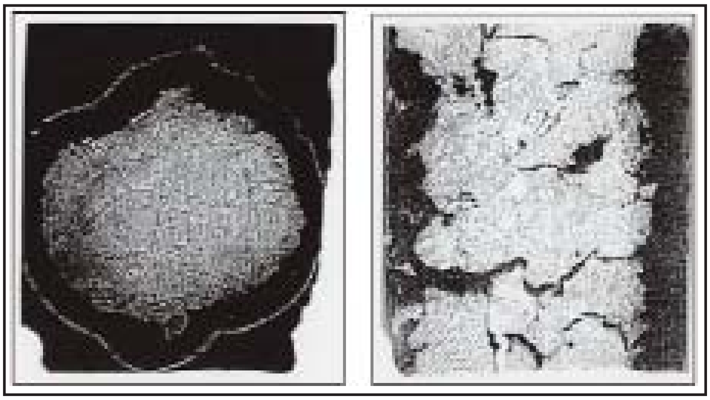

Figure 1. Corrosion Resistance. Actual cross-sections of positive grids show a more homogenous structure for pure-lead (Pb) on the left vs. lead-tin-calcium (Pb-Sn-Ca) on the right.

Quicker Recovery: Thick-grid designs in conventional batteries have higher resistance than their thin-plate counterparts, which limits current acceptance, generates heat and lengthens the charge cycle. By contrast, the thin-plate grids in TPPL batteries offer greater plate surface area and shortened ionic pathways, resulting in an overall reduction in internal impedance. With lower impedance, the TPPL batteries sustain a higher average voltage on constant power (CP) discharge. Additionally, reduced impedance allows the batteries to be charged in about half the time of conventional batteries, without sustaining damaging effects.

Practical Design and Performance Advantages

In addition to the basic characteristics of TPPL technology, the pure-lead battery design itself also offers many construction and performance advantages, which provide attractive cost-effective benefits, especially in remote, more demanding applications. These benefits help improve the efficiencies of the service provider by not only improving total cost but greatly reducing the attention needed on batteries and allowing more attention to be given to core competencies. Some of these design advantages include:

Greater Space Efficiency: The compact footprint of TPPL batteries offers advantages for new and replacement installations with space restrictions. With their capacity to deliver more ampere-hours in the same amount of space as a traditional battery specified in any OEM application, these TPPL batteries enable users to increase the backup power capacity of an installation in an existing cabinet's space or to reduce the potential cabinet size for future systems.

Tolerance to Temperature: Monitoring and maintenance requirements become a more critical and more costly consideration when batteries are situated in remote locations, where they can go unattended for long periods of time. Those concerns can also become more exaggerated in climates where extreme temperatures can impact battery performance at least part of the time. TPPL batteries are very tolerant of temperature swings from -40°C to 50°C.

Recovery Time: In real-world circumstances where power disruptions can occur frequently, and where extended outages can be caused by ice storms, hurricanes or heat-induced brownout conditions, battery construction can dictate how well the backup system will tolerate the interruptions and strains on the recharging process. Because TPPL batteries recharge in half the time of traditional batteries, this can make a difference in having the capacity to handle subsequent power interruptions.

Shelf Life: Unlike nuts-and-bolts hardware with a virtually unlimited shelf life, batteries are a perishable commodity. Managing battery inventories for optimum purchase efficiency and backup availability is enhanced by the low rate of self-discharge for TPPL batteries, providing up to three times longer shelf-life than conventional VRLA batteries.

Outgassing: Each time gas is discharged from a battery, the battery's performance is slightly, yet permanently, diminished. The more extreme and the more frequent the outgassing occurs, the more rapid the drop in battery performance and the quicker time to failure. The TPPL design allows for high recombination efficiency (typically more than 99 percent), which helps to maintain the battery at a higher level of function, thus increasing battery life. In addition, TPPL batteries require lower float currents, which reduce the outgassing associated with charging.

Thermal Management and Thermal Runaway: How TPPL batteries react to the heat in an overcharge situation also helps to protect them in several ways. When a lead-acid battery warms up, it draws more current, which in turn generates more heat. This can produce a vicious cycle that causes the battery to reach a critical stage in a matter of hours. TPPL batteries exhibit a more gradual increase in temperature, taking a longer amount of time for a battery to reach a critical stage in the event of a malfunction of thermal protection circuitry. This offers much more time for the problems to be discovered and remedied before the battery is destroyed.

Conclusion: Compare and Save

The only way to choose an optimum solution for your telecom application is to compare the performance of different flooded and VRLA battery technologies on paper and in field

Figure 2. Pure-Lead Batteries. TPPL batteries, such as EnerSys' SBS line of pure-lead batteries, offer telecom networking managers a lighter solution with a longer shelf life, longer service life and a higher-rate of efficiency than traditional batteries.

trials. The more money your company currently spends on backup battery systems and maintenance, the more you stand to save. Although it is important to evaluate your network requirements, it is even more important to make sure that the right battery technology is utilized for your telecom needs.

TPPL technology, which is offered by companies like EnerSys (see Figure 2), provides telecom battery users a solution with a higher energy density, which results in greater space efficiency; an advanced battery chemistry, which leads to a longer service life and greater tolerance to extreme temperatures; and a grid design, which allows for quicker recharging and that can make a difference in having the capacity to handle subsequent power interruptions.

All of these benefits result in a better performing solution that not only reduces total cost, but also allows network managers to focus valuable engineering and maintenance resources on the core competencies of the network and provide more enhanced solutions, which in turn increases revenue.

Contact EnerSys at www.enersysinc.com.

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