MYTHS AND PERFORMANCE PROBLEMS IN TELECOM NETWORK POWER

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ABSTRACT

This paper is intended to debunk myths and commonly held misconceptions about powering, grounding, and electrical protection for the telephone network, and identify several important criteria for doing business with telephone companies, niche applications for battery and related equipment.

Too often, the “One size fits all” mentality is responsible for systems that don’t perform very well and are expensive to build and maintain. This paper will explore engineering considerations and operational impact of battery systems that are falling short of the customer's expectations.

Myth: VRLA is the new battery for all telecom applications.
Reality:
The industry would have us believe that VRLA is the way telecommunications should go. Basically, there’s a "Let’s let bygones be bygones" approach to the convoluted performance history of these cells. Obviously, the industry has learned much over the past ten years, particularly about such nettlesome problems as thermal runaway and poor performance life. Still, though, other technologies still have a big place in the network.

Many telephone engineers believe that VRLA is anything but a ubiquitous solution. Rather, we see it as a niche technology. Fortunately, it’s an awfully big niche. Decentralizing the telephone network equipment literally is putting batteries everywhere on poles, underground, and in free-standing cabinets. Three factors contributing the most to VRLA failure in telecom use are heat, shelf time, and improper installation.

Any lead acid battery, from the earliest glass jar cells to today’s modern cells, will suffer from temperatures outside its design range. Since space reduction was a primary concern in VRLA development, packaging also is important. The trade-off between performance life and footprint is an eternal power struggle.

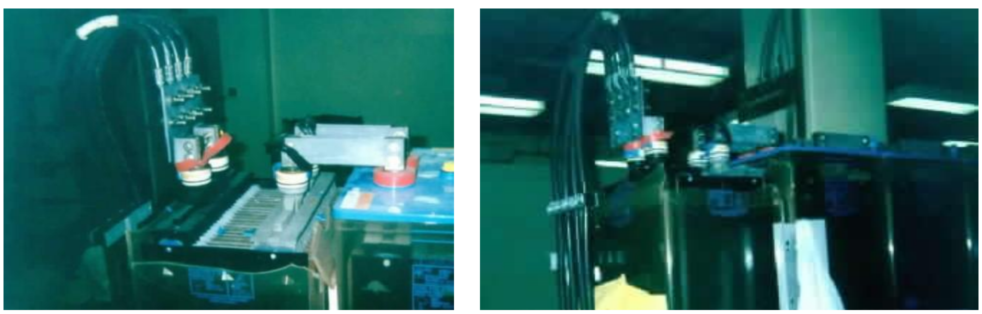
Figures 1 and 2. Cabinetized VRLA batteries share a spacious power room in this UPS application.

Batteries placed with little or no space between them will age more quickly. Likewise, poorly ventilated cabinets also will cause premature aging, and they increase the possibility of hydrogen accumulation. Around the US, a number of cabinet explosions have underscored this design flaw.

It's important for the specifying engineer to be sure the cabinet he or she uses is very well ventilated. Further, because burning batteries emit highly toxic smoke, users should train their employees to flee a fire rather than attempt to extinguish it. This is an important culture change, because telephone equipment technicians for many years were expected to attempt to extinguish fires in the network. Today, this could be a lethal error.

Myth: Battery containment is necessary for all telecom applications.
Reality:
For the past several years, folks are becoming excited over the battery containment issue. They reason that battery acid is highly corrosive, electrically conductive, etc., and poses a danger to fire fighters and other response personnel. There are some trying to push it through building codes and perhaps the National Electric Code. Obviously, telephone companies will abide by the codes; however, we believe the issue is way overblown. Most flooded type cells in telephone use are low gravity types. The specific gravity of the electrolyte is in the order of 1.220 of water. This is corrosive, but well within the capabilities of normal protective gear. Another stated reason for the requirement is the quantity of electrolyte on site. Left out is the fact that the electrolyte is contained in multiple jars, each containing only a few gallons of liquid. Serious jar failures are rare and usually affect only one cell. There is no history that would support a need for containment in telecom battery applications, beyond one accident with a significant spill. Even that was well managed with kitty litter and neutralized on site.

The most dramatic battery failures we've experienced, for example, put only a few ounces of electrolyte on the floor and do not justify spending the cost of a containment. The two most dramatic events in a flooded cell are meltdown and explosion; yet, in our experience, none of these has resulted in significant spillage.



Figures 3 and 4. Explosion damage.

Figures 5 and 6. Post meltdown damage.

Some suggested wording for the codes would require containment materials on all battery strings, even AGM and gelled electrolyte cells. This is a waste of money, since there's no free electrolyte in these cells. They can be transported on most highways without permits because they can't leak even when broken. Why, then, would they need a containment?

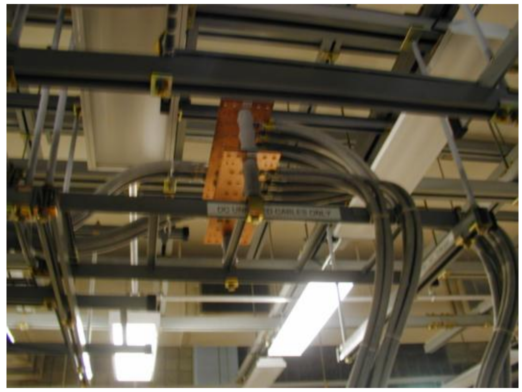
While some VRLA batteries have been used in central office applications, it's generally believed that flooded cells are more cost-effective for this application. They occupy a bit more space, but their greater reliability and longer life more than offset this. Because maintenance procedures generally are more defined in flooded technology, the strings tend to be better maintained. Cellular companies are reversing their trend towards VRLA and now are reconsidering flooded cells.

Myth: Low voltage disconnects will improve system reliability.
Reality:
Despite claims to the contrary, low voltage disconnects tend to degrade overall system reliability. There is a high incidence of false operation logged for these devices, and they are no longer used for most central office applications. The worst of these designs disconnect the load from the battery plant because they guarantee system failure on a false operation. If a low voltage disconnect must be used, placing it between the battery and the bus at least leaves the rectifiers to carry load during a false operation.

Myth: Installation knows what they're doing.
Reality:
A number of batteries, both flooded and VRLA, fail prematurely because of installation issues. Over and undercharging are serious errors that set into motion chemical reactions that can drastically shorten the service life of that battery. Some installers are using the wrong lugs on the battery cables. Because copper has an affinity for sulfuric acid, lugs for use on batteries should be lead plated. Not all installers follow that specification. Data from major telecommunications failures indicate that service lapses due to procedural error are rising drastically. Most are due to inadequate training and supervision, and missing, obsolete or inadequate documentation.

Figures 7 and 8. Severe cell sulphation.

A number of preventable accidents and telephone service interruptions have occurred due to exposed bus-work. There is no good reason to leave a bus exposed, and guards or covers would help to prevent these. Such covers should be made of flame retardant insulating materials that will pass the UL 94 flame test with a score of V-0 or V-1. A V-2 rating would not qualify. In the bus-work shown below, it's easy to see where accidents can happen. The bus is unfused, and potentials are very close together when adding or removing large lugs and cables. These physical design issues need addressing to avoid possible injuries and service reliability lapses.



Figures 9 and 10. Battery buses.

Myth: Data and Internet equipment needs 120 volts ac.
Reality:
In systems where reliability is needed, UPS's rarely are deployed, as they tend to be the weak link in a system. UPS systems typically have a battery reserve time of approximately 15 minutes, whereas a typical telephone battery is sized for three or more hours. Further, the higher bus voltage can cause battery fires or electrocution hazards. A growing body of telephone and data systems engineers are specifying 48 volts for all network elements, including routers and other networking systems. These offer a great deal of reliability at the penalty of slightly larger copper conductors.

Myth: Isolated grounding means isolated receptacles.
Reality:
Vendors often don't know where to ground equipment because an office is said to have isolated grounding for the switch and/or transport equipment. Some think this means to use orange (isolated) ac receptacles on any ac powered circuitry – these are almost never used in telecom applications. For the purposes of grounding the power plant, battery stands, and related equipment, the grounding bar called the "C.O. Ground Bar" or "Floor Ground Bar" nearly always suffices. If an office has some unique configuration, the telephone company grounding engineer for that site should be able to provide guidance.

Conclusions
Each battery technology has a niche in the business and which is right for what subject to change. As the industry grows together, direct communication between buyer and seller will help to keep myths from formulating. Operating companies need to invest in training for their engineers and pay more attention to a battery's history and the vendor's record of resolving problems, rather than believe the puffing on the cut sheets or simply buy the cheapest battery that money can buy for the application.