Service Bulletin

Bulletin No: SB-0015-19-233-SW Effective Date: 08-21-2019 Type: Informational

Subject: Charging Lithium Ion batteries with the SW35X turbine series.

Scope

This service bulletin provides information on charging lithium ion batteries with the Superwind 350 and Superwind 353 wind turbines.

Background

Superwind turbines have been successfully charging "Lithium" batteries for over a decade. Unlike charging standard battery types such as flooded lead acid, gel-cell and AGM (Absorbed Glass Mat), the charging of lithium-based batteries requires specialized knowledge and planning to avoid harm to life, limb and equipment.

Lithium-based batteries have been in use since the 1970s, but the safety record associated with them has always been a major concern. Advancements in lithium battery safety improved over time, finally reaching the off-grid energy storage marketplace in 2002 with the development and refinement of the LiFePO4 lithium iron phosphate battery. The cost of this battery was often prohibitive however, preventing many potential customers from adopting their use.

By 2010 a number of competing producers were manufacturing higher quantities of LiFePO4 batteries. This not only reduced cost, but more importantly made available lithium batteries packaged in standard sized "jars" (the plastic case or box containing the battery components). This meant that traditional batteries could now be pulled off the rack and be easily replaced with lithium batteries in the same standard sizes.

Prior to 2012 another common obstacle to the easy off-grid charging and use of lithium batteries was the complex "battery management systems" or BMS. Often mounted external to the battery case, the BMS had very limiting charging thresholds that, if violated, shut off the battery and required a manual reset. A number of lithium battery manufacturers thought these complex systems would be both a technology protection method as well as added safety. Instead, BMS charging parameters were out of sync with standard battery charging rules and their use actually hampered sales.

By 2012, high quality manufacturers of lithium batteries such as Valence (now owned by Lithium Works) began accepting IEC charging specifications comparable with standard, non-lithium battery charging. The result was that quality, adjustable solar or wind charge controllers could now be set to work within the charge requirement parameters of Valance LiFePO4 Batteries.

The Superwind SW-350 wind turbine system was the first and only micro-wind charger to be "Valence Verified," meaning it was appropriate for charging Valance LiFePO4 Batteries. This was noted for commercial as well as military applications and continued making news through 2014, when Superwind turbines were featured in DOD Energy Magazine (March 2014).

Five years later (2019) there are dozens of credible and reliable lithium battery manufacturers who have adopted Valence Battery's model of using standard size jars, as well as relocating the BMS inside the battery. This allows the use of standard battery connectors to receive the charge and discharge the energy.
As there are now so many new manufacturers (some with other "nearly as safe" chemistries as LiFePO4) the cost of quality lithium batteries had dropped significantly.
This lower cost and apparent "ease of use" can be misleading however, when using lithium batteries. Safety with any battery type is often taken for granted, but the result when damaging a traditional battery through incorrect charging techniques is quite different than improperly charging a lithium battery. Incorrect charging of a lithium battery can result in an explosion, fire and possibly a painful death to anyone proximate to a large lithium battery bank experiencing a thermal runaway event.
While safety is the most important aspect of charging lithium batteries, there are many others to be concerned with, such as load (use), charging sources (including regulation settings), charging strategies (including monitoring), low battery cut-offs and power diversion.
In the case of micro-wind charging of lithium batteries, understanding how the Superwind turbine avoids over-speed will also help the end user to understand how the SW-35X series helps protect an investment in lithium batteries by ensuring proper charging and management.

SW-350 Feature: The Ever-Loaded'™ Stator Control

When a small wind turbine spins freely without the proper electrical connection (a closed circuit between the batteries and charge regulator connected to the turbine stator) dangerous RPM, high voltage and amperage spikes can result – leading to the damage and eventual destruction of the turbine as well as other key components, such as charge regulators and batteries…

For decades, the small wind industry failed the end user by insisting that the wind turbine be turned off when there was 'too much wind' (typically about 25 knots). In commercial applications, especially those on high towers or in remote locations, these instructions are completely inappropriate.
In an attempt to fool customers, the manufacturers of inexpensive "hobby grade" wind turbines began the practice of artificially "loading" their wind turbines to bring them to a stop in high winds. Not only does this practice damage the wind turbine components (causing them to fail over time), but it also wastes precious battery power.
As this low cost, low technology trick fails it not only damages the turbine, but also the batteries used in the system – a costly price to pay for a cheap fix in efforts to save a low-quality wind turbine in high wind.
Superwind's turbine "system strategy" approach not only keeps the turbine loaded whenever there is wind, but also allows it to safely charge all types of commercially available battery types, including lithium – an industry first for wind turbines.
The Superwind turbine is designed with mechanical over-speed controls that limit how much energy can be sent to the charge regulation system. This allows for accurate and appropriate battery charging to occur, regardless of how much wind is impacting the turbine blades.
Because of this cutting-edge design technology, once properly installed the Superwind turbine can continuously operate in winds up 80 miles per hour – always staying connected to the

batteries (properly loaded) while continuously under charge regulation management to protect the battery bank from over charging. It also means that the wind turbine can remain online and charging a greater portion of time.
Once winds exceed the 80 Mph operational limit of the Superwind turbine, it can be shut down manually or autonomously via an optional switching system tied to a monitoring & SCADA system. With the stop switch in the "off" position, the Superwind turbine is rated for survival in winds up to 100 Mph.

Temperature Compensated Charge Control & Diversion Control
Wind turbine charge controllers are very different from solar panel charge controllers in that they are designed to electrically maintain the load correlation with the battery bank while simultaneously producing power above the ever-changing battery state of charge. This allows the batteries to be properly charged based on ideal temperature compensated charging rates (bulk, absorption, float and diversion).
The "diversion mode" of the charge controller engages when the batteries have reached their maximum charging voltage, at which time the Superwind Charge Controller's PWM circuit automatically diverts the wind turbine´s surplus power to the diversion load / power resistor block. Diverting power from a lithium battery bank can be dangerous. As such, it is important to restate that the SW-350 SRC charge controller diverts excess power from the charge controller itself – never from the battery bank!
With this charge strategy, even when batteries are fully charged, the wind turbine continues operating (generating usable power when there is ample wind) providing real time power to other electric consumers (loads) when they come online automatically or are switched on manually. For users located in extremely cold climates, the diversion system can also provide an additional heat source, allowing the batteries to be either in a state of charge or potentially "warmed" by the diversion load.

Charging Lithium Based Battery Types with the SW-35X turbine system
Lithium battery manufacturers are constantly changing the chemistry used within them. As these chemicals change often, users should never assume that an appropriate charge controller setting for one application will be appropriate for all others. Before charging a lithium battery with a SW-35X series turbine, the battery manufacturer's charging specifications must be reviewed and the company must approve the use of Superwind equipment. This approach will help protect batteries, while ensuring any battery warranties are not voided.
The SW-350 SRC Charge controller can be used to safely charge many lithium batteries. Integration of a Superwind turbine with a lithium battery bank is accomplished by the use of several custom options for the SCR 12V & 24V charge controller, such as temperature compensation elimination and by adjusting the diversion stetting.
In the case of the SCR 48V charge controller, the temperature compensation system can be changed by the installer or end user. Altering the diversion setting for any of the three types of SCRs must be done by the factory or an authorized distributor. Failure to do this will void the warranty of the SCR.

To be certain of charging and integration success, please contact Mission Critical Energy at (716) 276-8465 or visit us at www.missioncriticalenergy.com.

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