



EVOLUTION IN BATTERY ENERGY DENSITIES

TO SATISFY THE INCREASING OPERATIONAL EXPECTATIONS OF STABLE GRID DEPLOYMENTS



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INTRODUCTION

For decades stable grid energy storage applications have often been addressed by using either Valve-Regulated Lead-Acid (VRLA) gel tubular OPzV or flooded OPzS batteries. Across Europe, these batteries have been incorporated into the infrastructure of utilities, telecommunication providers, and oil and gas companies, as well as being featured in many industrial facilities too. There are strong reasons why they have been so popular in the past, and are thereby still widely deployed as legacy items. Most notable of these is the long operating lifespans that they could achieve, but also their relatively low cost and good reliability. In a modern context, however, the drawbacks of OPzV and particularly OPzS technologies are becoming increasingly clear - and the time has now come for implementing changes.

With rising power demands being seen, especially in increasingly space-limited installations, in some cases the power densities of OPzV/OPzS batteries are no longer sufficient for stable grid float applications. All this is further exacerbated by flooded type batteries requiring a high degree of accompanying ventilation for attending to gas emissions coming from the chemical reactions taking place within the cells. Such ventilation adds to the ongoing operational costs involved, as well as potentially requiring a provision for dedicated battery rooms that take up additional space and can present logistical complications.

In the case of OPzS, there will be the financial outlay associated with maintenance to factor in - since the batteries need periodic topping-up as water is being constantly lost from inside the battery as part of the chemical reaction process. Not topping-up these batteries will lead to premature failure. This can be particularly problematic when installation sites are situated in hard-to-reach places or requiring engineers to travel long distances.

There are safety concerns to consider too. With OPzS batteries, there is the potential risk of acid spillages. It is essential that companies using them put well-defined workflow procedures in place to protect their staff from any risk of injury. Also, if an

accident were to happen, such companies need to be prepared for carrying out responsive measures and have related amenities such as suitably stocked first aid kits, eyewash stations, etc. The prospect of dangerous spillage situations has transportation implications too, and these can result in major difficulties in some cases, including additional costs. Furthermore, OPzS batteries can only be configured in an upright position to avoid acid leakage - meaning that they have serious restrictions in terms of deployment versatility.

For OPzV, thermal characteristics such as the storage conditions and the operating temperature range, can be a challenge. Batteries based on this technology will often be deployed in places with very little temperature control (such as electrical grid substations, remotely situated telecommunication network equipment, etc.). As is the case for all lead-acid batteries, higher temperature levels will shorten the design life. Colder conditions will have a detrimental effect on charge acceptance, discharge performance, roundtrip performance, available capacity and other operative functions. The runtime that can be supported will vary quite dramatically with respect to seasonal changes in the ambient environment, due to the reduced temperature flexibility exhibited.

UPGRADING TRADITIONAL BATTERIES TO THIN PLATE PURE LEAD

Across the numerous industry sectors where OPzS and OPzS usage has been commonplace, there is a need to make a positive incremental change. An energy storage solution is called for that will have real functional and logistical benefits, but without unwanted and costly disruption. The engineering challenges of either moving to a whole new battery technology or having to accommodate a different battery form factor are simply too great for many. Instead, what is required is something that pushes the performance envelope while still effectively acting as a direct drop-in replacement upgrade.

Developed specifically to support modern stable float energy storage applications, EnerSys® PowerSafe® SBS XL 2V batteries can provide customers with the properties that originally made OPzS and OPzS units so appealing, such as assured operational longevity, combined with the latest innovation in thin plate pure lead (TPPL) technology.



Figure 1:
The TPPL-based EnerSys® PowerSafe® SBS XL 2V battery series
- a modern alternative to conventional OPzS and OPzS batteries

AN ENERGY STORAGE SOLUTION IS CALLED FOR THAT WILL HAVE REAL FUNCTIONAL AND LOGISTICAL BENEFITS, BUT WITHOUT UNWANTED AND COSTLY DISRUPTION.

TANGIBLE ENERGY STORAGE ADVANTAGES

PowerSafe® SBS XL 2V batteries leverage the expertise that EnerSys® has built up in relation to TPPL-based energy storage. The nature of TPPL technology and the associated manufacturing process enable more plates to be fitted in a given area. The upshot of this is that elevated levels of energy density are delivered. Another critical attribute is the structural integrity of the grids used in these batteries. EnerSys® TPPL grids are 99.99% pure lead. This means that they are much less vulnerable to the corrosion effects that shorten the lifespan of lead-calcium valve-regulated lead-acid (VRLA) batteries considerably.

ENERSYS® TPPL
 GRIDS ARE
99.99%
 PURE LEAD.

The storage capacities that PowerSafe® SBS XL 2V batteries can achieve are markedly better than with size-equivalent OPzV and OPzS - with Ampere-hour (Ah) capacity figures being as much as 51%* better than size-equivalent OPzV/OPzS units in some cases. Single cells can offer up to 3900Ah capacity, which is something that batteries based on OPzV/OPzS technologies simply cannot match. Significant storage capacity increases can be realised, without taking up extra space. There are also advantages with regard to extended lifespan longevity. Tables 1 and 2 describe the beneficial attributes they have when compared to OPzV and OPzS batteries respectively.

Traditional OPzS Battery		PowerSafe® SBS XL 2V Battery	
Long life	✓	Long life	✓
Maintenance cost issues	✗	Minimal maintenance required	✓
Safety concerns (due to spillage risks)	✗	Assured safe operation	✓
Relatively low capacity	✗	Boosted capacity thanks to greater energy density	✓
Transportation challenges	✗	Simple to transport	✓
Vertical installation only	✗	Horizontal and vertical installation	✓
Slow to recharge	✗	Rapid recharge times	✓
Reduced operating temperature range	✗	Can operate effectively within a wider temperature range	✓
Legacy solution	✗	Fully optimised stable grid float solution	✓

Table 1: Comparison of characteristics OPzS and PowerSafe® SBS XL 2V batteries

Traditional OPzV Battery		PowerSafe® SBS XL 2V Battery	
Long life	✓	Long life	✓
Reduced operating temperature range	✗	Can operate effectively within a wider temperature range	✓
Slow to recharge	✗	Rapid recharge times	✓
Relatively low capacity	✗	Boosted capacity thanks to greater energy density	✓
Legacy solution	✗	Fully optimised stable grid float solution	✓

Table 2: Comparison of characteristics OPzV and PowerSafe® SBS XL 2V batteries

Supplied in industry-recognised 320Ah to 3900Ah cell versions, PowerSafe® SBS XL 2V batteries comply with the dimensional requirements outlined by the DIN 40742 standard. As a result, the series are aligned to the same sizes that customers using OPzV and OPzS are already familiar with. Additionally, the robustness of the UL94 V-0** boxes and lids enable these batteries to be used in even the most difficult of application environments.

By having identical form factors, but greater available energy densities than OPzV and OPzS, it is straightforward for engineers to swap their existing solutions for PowerSafe® SBS XL 2V batteries and gain distinct performance advantages. The need for undertaking a redesign of equipment rooms or having to reconfigure racks is completely avoided. Conversely, in new deployments, the density enhancements substantially reduce the amount of physical space needing to be assigned to energy storage functions.

PowerSafe® OPzV Battery		PowerSafe® SBS XL 2V Battery		Capacity Advantage over OPzV (C10/1.80Vpc/20°C)
Cell Type	Nominal Capacity (C10/1.80Vpc/20°C)	Cell Type	Nominal Capacity (C10/1.80Vpc/20°C)	PowerSafe® SBS XL 2V Battery
4 OPzV 200	215	SBS XL 320	320	49%
5 OPzV 250	265	SBS XL 400	400	51%
6 OPzV 300	320	SBS XL 480	480	50%
5 OPzV 350	385	SBS XL 580	580	51%
6 OPzV 420	465	SBS XL 680	680	46%
7 OPzV 490	540	SBS XL 780	780	44%
6 OPzV 600	705	SBS XL 900	900	28%
6 OPzV 600	705	SBS XL 970	970	38%
8 OPzV 800	940	SBS XL 1200	1260	34%
10 OPzV 1000	1170	SBS XL 1500	1560	33%
12 OPzV 1200	1410	SBS XL 1800	1870	33%
16 OPzV 2000	2110	SBS XL 2700	2700	28%
20 OPzV 2500	2640	SBS XL 3100	3100	17%
24 OPzV 3000	3170	SBS XL 3900	3900	23%

Table 3: Capacity improvements PowerSafe® SBS XL 2V batteries offer compared to equivalent-sized OPzV battery units

Thanks to the prolonged operational life of PowerSafe® SBS XL 2V batteries, fewer change-outs may be needed compared to traditional Absorbed Glass Mat (AGM) cells. As a result, the capital expenditure associated with sourcing new batteries and the labour costs of future battery replacements will be less of a problem.

Finally, PowerSafe® SBS XL 2V batteries support 2-year shelf lives at 20°C, whereas OPzV/OPzS units will need recharging at 12 and 3 months, respectively. This is a real plus point when (as often happens) batteries have been procured ready for installation, and there are then unforeseen project hold-ups.

BY HAVING IDENTICAL FORM FACTORS, BUT GREATER AVAILABLE ENERGY DENSITIES THAN OPZV AND OPZS, IT IS STRAIGHTFORWARD FOR ENGINEERS TO SWAP THEIR EXISTING SOLUTIONS FOR **POWERSAFE® SBS XL 2V BATTERIES** AND GAIN DISTINCT PERFORMANCE ADVANTAGES.

CONCLUSION

Batteries using OPzV or OPzS units have been acceptable in stable grid float scenarios for many years, however, their apparent limitations and deficiencies now mean that a new approach is warranted, and available. Battery solutions are required that not only offer prolonged working lifespans, but also greater energy densities and better temperature related properties.

By selecting PowerSafe® SBS XL 2V batteries, customers will be able to attain the battery design lives that they have come to expect from OPzV and OPzS technologies - while also being able to attain higher energy densities, overcoming the temperature range issues of the former and reducing maintenance effort of the latter. This is the next evolutionary step in stable grid energy storage.



Figure 2:
A detailed cutaway of a PowerSafe® SBS XL 2V Battery cell with TPPL technology"

BATTERY SOLUTIONS ARE REQUIRED THAT NOT ONLY OFFER PROLONGED WORKING LIFESPANS, BUT ALSO GREATER ENERGY DENSITIES AND BETTER TEMPERATURE RELATED PROPERTIES.

***Note:**

The capacity improvement is representative when comparing at C10/1.80Vpc/20°C Ah capacities.

****Note:**

Testing conducted in line with the UL94 V-0 for Flammability of Plastic Materials for Parts in Devices and Appliances standard.

CONTACT ENERSYS®

For more information about the high-performance, long-life batteries for commercial and industrial applications available from EnerSys®, please visit: [enersys.com](https://www.enersys.com)

OUR PRODUCTS FACILITATE POSITIVE ENVIRONMENTAL, SOCIAL, AND ECONOMIC IMPACTS AROUND THE WORLD.

About EnerSys®

EnerSys®, the global leader in stored energy solutions for industrial applications, manufactures and distributes energy systems solutions and motive power batteries, specialty batteries, battery chargers, power equipment, battery accessories and outdoor equipment enclosure solutions to customers worldwide. Energy Systems, which combine enclosures, power conversion, power distribution and energy storage, are used in the telecommunication, broadband and utility industries, uninterruptible power supplies, and numerous applications requiring stored energy solutions. Motive power batteries and chargers are utilized in electric forklift trucks and other industrial electric powered vehicles. Specialty batteries are used in aerospace and defense applications, large over-the-road trucks, premium automotive, medical and security systems applications. EnerSys® also provides aftermarket and customer support services to its customers in over 100 countries through its sales and manufacturing locations around the world. With the NorthStar acquisition, EnerSys® has solidified its position as the market leader for premium Thin Plate Pure Lead batteries which are sold across all three lines of business.

Sustainability

Sustainability at EnerSys is about more than just the benefits and impacts of our products. Our commitment to sustainability encompasses many important environmental, social and governance issues. Sustainability is a fundamental part of how we manage our own operations. Minimizing our environmental footprint is a priority. Sustainability is our commitment to our employees, our customers, and the communities we serve. Our products facilitate positive environmental, social, and economic impacts around the world. To learn more visit: <https://www.enersys.com/en/about-us/sustainability>.

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