EEnews

14.11.2018

Simplifying backup

By Mikael Greis

Reliable batteries give confidence that industrial systems will work as expected and protect people, property and wider environment. Well-proven technology such as nickel pocket plate batteries is effective from a cost and operational point of view. However, some operators are concerned that nickel batteries may require more complex charging arrangements than lead-acid batteries. New research and development activity has focused on addressing this challenge.

Backup batteries in demanding industrial environments need to be reliable even in the toughest conditions. They are installed in remote and inhospitable locations like oil and gas exploration and production platforms, on unmanned utility substations, or in highly-automated manufacturing facilities.

The batteries must be able to deliver power when needed for safe plant shut-down or operation of process control systems, ensure continuity of mission-critical loads or reconfigure switchgear. Alternatively, they may be needed to provide a power bridge until backup generators can be brought online, safeguarding of data racks, or supporting power for fire alarms,

emergency lighting and security systems.

All of these are faced with a combination of challenges presented by limited access, a need to comply with safety standards and procedures and a requirement for highly trained technicians.

Simplifying standby power

The latest generation of pocket plate nickel batteries, such as Saft's Uptimax, have evolved to provide better chargeability alongside their high level of reliability. This chargeability enables a more straightforward arrangement of the battery chargers.

As batteries receive power, their voltage rises as their State of Charge (SOC) rises and they become saturated with energy. On conventional nickel batteries the voltage window is relatively wide. In turn, this means that battery chargers for conventional nickel batteries must be adapted to first deliver a boost charge to bring the battery up to capacity and then a nominal 'float' charging voltage to maintain the charge.

Therefore, to be able to deliver the two charging levels for nickel batteries, additional dropping diodes must be built into the charger units. The charger provides the boost charge and when it detects the voltage rise it then switches over to deliver the float charge.

Recent development activity by Saft's researchers in Bordeaux, France, as well as at its product development team in Oskarshamn, Sweden, has focused on the active materials inside the battery. This builds on the improvements delivered over multiple generations of the technology.

Subtle but important changes to the electrochemistry now enables the Uptimax to be charged within a single, narrow voltage window of 1.39 V/cell. As a result, the updated batteries are compatible with all commonly used Direct Current (DC) charging systems. An added benefit is that, should fast recharge be needed, 95 percent SOC can be reached in 8 hours at 1.45 V/cell for minimal downtime and optimal availability.

Narrow voltage window to be the new norm for nickel

Since the change to the active materials in its batteries, Saft shifted production fully over to the new narrow voltage model in September 2018. Reaction from customers has been positive since Saft has demonstrated the potential benefits. Industrial operators always welcome technological improvements that deliver real-world savings from enhanced reliability or reduced maintenance costs.

Because only the electrochemically active materials have been changed inside the batteries, the mechanical design is unchanged. Therefore, nickel batteries with a narrow voltage window can be installed as a direct 'plug and play' replacement for either lead-acid batteries or for previous generations of nickel batteries.

Being mechanically identical to previous models also guarantees the availability and compatibility of spares for many years to come.

However, improvement is a continuous and constant process. Having upgraded its technology to eliminate dual-level charging, Saft's development team has turned its attention to future improvements. The focus is now on reducing the operational cost for customers and in particular reducing maintenance requirements without reducing reliability.

Straightforward charging

A major benefit of having a narrow window for charging voltage is that it enables nickel pocket plate batteries to be used as a direct replacement for conventional lead-acid batteries. The enhanced chargeability and narrow voltage window means that dropping diodes can be eliminated from the battery charger.

As a result, industrial operators can achieve significant savings from the low maintenance, long service life and high reliability of nickel-technology batteries.

In addition, in the case of a power failure, the battery will support the load without the need to rely on a number of electronic components. Not only does the reduced number of components mean that the backup system is inherently more reliable, but less engineering is required, meaning lower capital and operational expenditures (CAPEX and OPEX).

Reliability benefit of nickel batteries

Aside from their enhanced chargeability, the latest pocket plate batteries have other advantages over lead-acid technology, particularly in terms of predictable performance, low maintenance requirements and low Total Cost of Ownership (TCO).

Many operators have legacy installations with lead-acid technology. While lead-acid batteries are well known and widely used, they have relatively high maintenance and operational requirements, such as regular capacity testing. In addition, lead-acid technology can suffer from something called sudden death. This is a sudden and irreversible failure that is due to the battery's internal structure being eroded over time by the electrochemical reactions – and finally losing mechanical integrity. Nickel batteries do not experience sudden death, and instead deliver predictable performance over their life.

Nickel batteries also offer a much longer service life – mean-

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ing much longer intervals between replacement cycles. In fact, customers regularly report to us that they have battery installations that are more than 20 years old. This is a particular benefit in remote and isolated installations, where the cost and logistical challenge of replacing batteries can be high.

Two further factors that keep the TCO under control is *low* maintenance and relatively light weight compared with lead-acid. Batteries like the Uptimax don't require any topping up. This means that site visits can be kept to a minimum and can be coordinated with other activities, avoiding the need to schedule technician time just for the batteries. In addition, being lighter than lead-acid, they are easier to handle and do not have the costly level of lifting and handling requirements.

While the performance of lead-acid batteries can suffer in extreme high or low operating temperatures, nickel technology batteries deliver reliable performance over a wider temperature range. It is true that high temperatures will cause premature aging for all types of electrochemistry. But while a temperature increase of just 10°C will reduce the expected life of a lead-acid battery by 50 percent, an equivalent nickel battery will lose only 20 percent of its life in the same conditions.

Lower operating temperatures, especially in extreme winter conditions will also impact the battery performance. Engineers often overcome this by oversizing their lead-acid battery installations to ensure they have enough power capacity even in the depths of winter. Because nickel batteries are able to perform better at lower temperatures there is less need for them to be oversized.

Overall, a further benefit of switching to nickel from lead-acid is that operators can reduce or even eliminate the need for air conditioning or heating equipment for their battery systems, with no need to oversize the batteries. This offers another valuable saving in both installation and maintenance costs.