

Flash Battery offers insight into high-voltage batteries, what they are, suitable applications and the components which help protect operators and maintenance personnel.

SAFETY IN PERFORMANCE

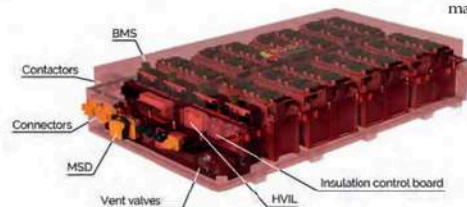


Customized high-voltage battery for a hybrid tracked crane in the construction market

components.

In addition, the high-voltage interlock system utilizes a continuous low-voltage circuit to monitor the correct connection of all high-voltage components across the vehicle. If the HVIL signal is interrupted, the high-voltage current is immediately interrupted.

Where all these are automated systems, the mechanical safety disconnect (MSD) is a manual device activated during maintenance operations to physically



The safety components in a high-voltage battery pack by Flash Battery

The growing share of electrified models in the industrial vehicle market now extends to larger machines with higher power. Delivering the increased power demand of models in this segment has been supported by a series of technology advances in lithium batteries and in particular high-voltage lithium batteries.

THE WHAT AND THE WHY

Looking at industrial and off-highway applications, low-voltage batteries are commonly defined as units up to 102.4 V nominal. This, despite regulations defining low-voltage batteries as 60 V. High-voltage batteries start from 300 V and can deliver in excess of 800 V.

Flash Battery explained that the cost of a low-voltage battery is less than a high-voltage solution because the components in the low-voltage models are easy to source and do not need the updated components required to handle higher currents, such as dedicated connectors or safety devices.

A low-voltage solution, though, simply cannot be adapted for use in a high-power system. This is due in large part to the output power of the electric motor, which has a direct influence on the choice of voltage; in industrial and off-highway applications, motors above 20 or 30 kW need a higher voltage to be compact and operate efficiently.

Flash Battery said that some OEMs are still skeptical when it comes to high-voltage solutions, often because they are concerned of the safety aspects. But it is important to underline how high-voltage batteries require stringent safety measures and protocols to ensure both operator safety and system reliability.

THE HOW

Flash Battery recently developed a 396.8 V 420 Ah battery (166.6 kWh) for a hybrid tracked crane. Given the high power demand, the solution required four battery packs in a series configuration, but separated into two different areas of the frame. The system included an

integrated control system using an insulated high-voltage interlock system (HVIL) to meet the safety standards required by high-voltage applications. The project required a mechanical study for the positioning of the batteries within the vehicle frame.

The project was based on three key pillars: chemistry, smart assembly and advanced proprietary control electronics.

BATTERY PACKS

According to Flash Battery, lithium ferrophosphate (LFP) cell chemistry is now considered the best choice for industrial applications, both for its efficiency and safety. Additionally, LFP has a long life – over 4,000 charge cycles – while also being the most stable chemistry currently available.

Battery cell assembly is another important safety aspect. Of particular concern is the cell capacity and consequently the number of cells connected in parallel within a battery pack.

Using smaller battery cells inevitably requires more parallel connections within the pack to reach the requested capacity, but increasing the number of connections raises the risk of a short circuit. Packs produced by Flash Battery use no more than four cells in parallel: tests have shown that the design delivers the safest solution.

COMPONENT ROLL CALL

There are other components which play a fundamental safety role in a high-voltage battery pack. These include fuses to interrupt the current if overcharging or a short circuit is detected, together with contactors which can break the circuit and limit damage to the system

ILLUSTRATIONS: FLASH BATTERY



BATTERY VOLTAGE

24V

48V

96V

300-400V

>600-700V

Correspondence between battery voltage and motor power (these tables report generic parameters as examples)

ILLUSTRATIONS: FLASH BATTERY



MOTOR POWER

0.3-3.5kW

3.5-15kW

15-40kW

40-70kW

>70kW

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