Technology choices for telematics back-up batteries

Telematics system emergency back-up batteries must provide instantaneous high power, operate in a temperature range of -40 to +85°C, be safe for use within the passenger compartment and have a ten-year shelf life. This narrows the choice of chemistry to a non-rechargeable lithium solution. David Richards, Ultralife Batteries Inc

There are a few different lithium primary (non-rechargeable) systems to choose from and these can be divided into two types: those with a liquid cathode and those with a solid cathode. Liquid cathode systems, such as lithium-sulphur dioxide (Li-$S0_2$) and lithium-thionyl chloride (Li-$SOCl_2$), must incorporate a chemical passivation layer on the surface of the lithium anode to prevent the cell from instantly discharging. The lithium becomes heavily passivated after storage and this is exacerbated at the high temperatures often found inside vehicles. As a result, they may not be able to operate for several minutes, if at all, at low temperature. This is not the case with solid cathode systems, such as lithium-manganese dioxide (Li-MnO_2) or lithium-carbon monofluoride (Li-CFx) where the anode and cathode are physically separated, avoiding the need for a chemical passivation layer.

Safety concerns

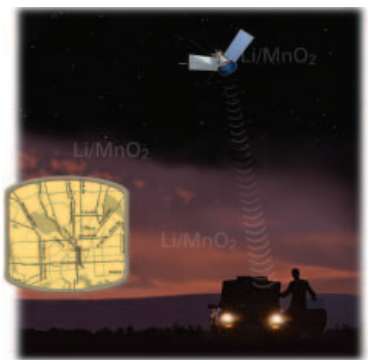
Liquid-cathode electrolytes are based on sulphur compounds that are both toxic and corrosive. If one of these cells leaks or vents, releasing the electrolyte into the passenger compartment, then breathing will rapidly become a challenge. The electrolyte in solid-cathode systems is neither toxic nor corrosive. However, it is flammable but none of the electrolyte will be expelled from inside the cell, providing the cell does not vent on short circuit. This is achieved through the use of a shutdown separator between the cathode and anode that closes the cell down in the event of a short circuit. This system cannot be used in liquid-cathode systems.

Sealed-lead acid (SLA) rechargeable batteries have been considered for telematics back-up, however, these present disadvantages, including added weight and volume and the complexity of a charging circuit with temperature compensation. A typical 12-volt SLA battery weighing 1.1kg, with a volume of 432cc is nearly five-times heavier and three-times larger than a 12V lithium battery weighing 232g, with a volume of 132cc.

In the event of a vehicle fire, it is essential that the back-up battery pose no additional safety hazard to firefighters. That is to say that it should not explode if exposed to excessive heat or fire. Because liquid-cathode systems are pressurised, any safety vent that they have must operate at relatively high pressures (600–1000 psi), whereas the solid-cathode systems are not pressurised and, therefore, have a low-pressure vent that operates between 200 and 250psi. Clearly this low-pressure vent presents a lower level of hazard.

The power requirements of the telematics transceiver are considerable and the back-up battery must be able to meet these across the entire temperature range. There are also inevitable space restrictions meaning that the back-up battery must be both small and powerful. Li-CFx batteries are not renowned for their ability to provide high currents, especially at low temperature and, as a result, a significantly larger battery is needed than with manganese dioxide.

In order to ensure that the telematics unit, in the event of an accident, can notify the emergency services, it is essential that a back-up battery be fitted. It is also vital that that battery should operate under all conditions and that it should pose no risk to the vehicle occupants. The choice of battery technology is critical and all the indications are that the only choice is a primary lithium-manganese di-oxide battery. ■



A back-up battery is critical for telematics systems in the event the main battery becomes disconnected.

Author

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