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Battery Management Systems Crucial ESS Consideration

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Agenda

- Background
- Defining BMS
- Standards Referencing BMS
- Standards Comparison
- Summary

Background

As Energy Storage Systems (ESS) quickly populate our open lots and garages ensuring these systems can operate safely is critical. The primary focus of this presentation is lithium chemistry based ESS as they are typically the most volatile and created the most incidents.

South Korea has had 15 ESS fires in 2018

S & C (Wisconsin, 2016)

Port Angeles Mall (Washington, 2013)

Background

A BMS (Battery Management System) serves as the brain of ESS systems and is responsible for deciding when to charge and discharge the batteries along with monitoring the cells to determine if any conditions exist that may result in a hazardous situation. Finally the BMS also communicates to the outside world about the status of the ESS.

With this in mind it is pretty clear the BMS is one of if not the most critical component in an ESS.

Intended to address BMS used in Energy Storage, Industrial and Photovoltaic

Communication and EMC standards not included

Defining BMS

What is a BMS?

A battery management system (BMS) is defined in many safety standards. A quick look at the IEC standards referencing BMS shows the variation within one organization.

IEC 61427-2: Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 2: On-grid applications

electronic system associated with a battery which monitors and/or manages its state, calculates secondary data, reports that data and/or controls its environment to influence the battery's performance and/or service life

Defining BMS

IEC 62620: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for use in industrial applications

electronic system associated with a battery which monitors and/or manages its state, calculates secondary data, reports that data and/or controls its environment to influence the battery's **safety, performance and/or service life and has the functions to cut off in case of **over charging, over current and over heating****

Note 1 to entry: The function of the BMS can be assigned to the battery pack or to equipment that uses the battery.

Note 2 to entry: A BMS is sometimes also referred to as a BMU (battery management unit).

Defining BMS

IEC 62619: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications

electronic system associated with a battery which has functions to cut off in case of overcharge, overcurrent, **overdischarge**, and overheating

Note 1 to entry: It monitors and/or manages its state, calculates secondary data, reports that data and/or controls its environment to influence the battery's safety, performance and/or service life.

Note 2 to entry: Overdischarge cut off is not mandatory if there is an agreement between the cell manufacturer and the customer.

Note 3 to entry: The function of the BMS can be assigned to the battery pack or to equipment that uses the battery. (See Figure 5)

Note 4 to entry: The BMS can be divided and it can be found partially in the battery pack and partially on the equipment that uses the battery. (See Figure 5)

Note 5 to entry: The BMS is sometimes also referred to as a BMU (battery management unit)

Standards Referencing BMS

IEC 62619: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications (8.2)

IEEE 1679.1 - Guide for the Characterization and Evaluation of Lithium-Based Batteries in Stationary Applications (5.7, 5.8, 7.2)

NAVSEA S9310: Technical Manual for Batteries, Navy Lithium Safety Program Responsibilities and Procedures (2.3.7.2, Appendix A)

Standards Referencing BMS

UL 1973: Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications (7.8)

UL 9540: Standard for Energy Storage Systems and Equipment (Appendix B)

Standards Referencing BMS

CSA C22.2 No. 340: Battery Management Systems

IEC 62485-5: Safety requirements for secondary batteries and battery installations - Part 5: Safe operation of stationary lithium-ion batteries (7.1, 7.2)

IEC 63056: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems (7.9)

IEEE P2686 - Recommended Practice for Battery Management Systems in Energy Storage Applications

Standards Comparison

	Overcharge (V)	Overcharge (A)	Overheating	Cell Balancing	Disconnect Devices
IEC 62619	X	X	X		
IEEE 1679.1				X	X
NAVSEA S9310	D	D			
UL 1973	X	X			
UL 9540	X	X			

Standards Comparison

	Thermal Management	Heating and Cooling	Thermal Fault	Short Circuit	Overdischarge
IEC 62619					
IEEE 1679.1	X	X	X		
NAVSEA S9310				D	D
UL 1973	X				X
UL 9540	X				X

Standards Comparison

	Cell Operating Region	Temperature Range	Functional Safety
IEC 62619	X		X
IEEE 1679.1	X	X	
NAVSEA S9310			
UL 1973	X		X
UL 9540	X		X

Summary

So what do we really need?

Summary of existing requirements

Overcharge

Overdischarge

Overheating (cell)

Cell Balancing

Disconnect Device

Thermal Management

Summary

Heating and Cooling

Thermal Fault

Short Circuit

Overvoltage

Cell Operating Region

Temperature Range

Functional Safety

Summary

Gaps in current requirements

Undervoltage

Temperature of BMS Components

Current Monitoring

EMC

Environmental

Functionality Over Temperature Range

Other Applications

Error Mitigation

BMS Component Ratings

Summary

Functional Safety

Certification organizations are not consistent which makes it challenging for manufacturers to achieve compliance and develop solutions across multiple applications.”

In an ideal world we would have a baseline developed around battery safety that could be expanded to handle design changes and end product variation

Summary

Solutions?

Multiple organizations are developing standards that will address the BMS as a component to bring consistency to the evaluation and ease the requirements for the end product manufacturer seeking compliance.

Speaker Biography

Jody Leber is a Senior Technologist in Energy Storage at CSA Group and participates on the following committees.

- American National Standards Institute (ANSI) Battery for C18.1, C18.2 and C18.3 Series (voting)
- Standards Technical Panel (STP) for UL 1642, UL 1973, UL 2054, UL 2271, UL 2272, UL 2580, UL 2738, UL 2743, UL 2849, UL 8139 and UL 9540 (voting)
- US TAG for TC 21, TC 120, TC 35 and SC 21A (voting)
- Technical Advisor (TA) for TC21
- Deputy Technical Advisor for SC21A
- SAE Battery Safety (voting)



Questions?



Thank you.