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Project Abstract

The goal of the SEABAT project is to develop a full-electric maritime hybrid battery concept that is based on:

- modularly combining high-energy batteries and high-power batteries,
- novel converter concepts and
- production technology solutions derived from the automotive sector.

The modular approach will reduce component costs (battery cells, converters) so that unique ship designs can profit from economies of scale by using standardized low-cost components. The concept will be suitable for ships requiring up to 1 MWh of storage or more.

Public summary

The primary objective of WP 6 is to verify that the HESS (Hybrid Energy Storage System) meets the requirements outlined in WP2 and the specifications from WP3. The validation process for the HESS involves two steps: a power-hardware-in-the-loop (P-HIL) virtual integration and validation test, and a performance test of the entire battery system.

This document provides a comprehensive overview of the P-HIL setup, which includes virtual integration, fault tolerance, and fault ride-through testing. The document also describes the necessary modifications to the control system and discusses the limitations of the test setup.

The P-HIL setup consists of two physical battery modules and is developed in Task 6.2. While some components of the test setup are physical, most of the components are simulated by a real-time simulator and controlled voltage sources. The setup will be utilized for testing the hardware and software of the master controller, string controller, and module controller, including the DCDC controller and BMS system. The tests to be conducted in Task 6.3 include the integration of the controllers, control functionality, and fault handling of the control systems, virtual integration with the vessel power system, and virtual upscaling of the battery system.

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Abbreviations

AI	Analog Input
BMS	Battery Management system
DI	Digital input
EMT	Electromagnetic Transient
ESS	Energy Storage System
HE	High-energy
HESS	Hybrid Energy Storage System
HIL	Hardware-In-the-Loop
HP	High-power
LTO	Lithium-Titanate Battery
NMC	Nickel Manganese Cobalt
NTC	Negative Temperature Coefficient
P-HIL	Power-Hardware-in-the-Loop
PMS	Power Management System
PWM	Pulse Width Modulation
RMS	Root Mean Square
SOC	State of Charge
SOF	State of Function
SOH	State of Health
TVS	Transient-Voltage-Suppression

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