

UL 9540 & IEC 62619 Technical Compliance Register: Local Grid Operator Interconnect Approval Template

UL 9540 & IEC 62619 TECHNICAL COMPLIANCE REGISTER

This document serves as the authoritative compliance and technical reference for the Local Grid Operator Interconnect Approval Template, a standardized documentation framework engineered to accelerate and de-risk the interconnection of commercial and industrial Battery Energy Storage Systems (BESS) with local distribution networks. Developed in accordance with the rigorous safety and performance criteria of UL 9540, UL 9540A, IEC 62619, and IEEE 1547, this template provides grid operators, EPCs, and asset owners with a unified, verifiable data package that streamlines the approval process from initial application to final commissioning.



SYSTEM ARCHITECTURE & SAFETY

At the core of the interconnect approval template is a modular, tier-1 LFP battery architecture integrated with a bi-directional Power Conversion System (PCS) and an advanced Energy Management System (EMS). The system is designed for seamless grid-parallel and grid-forming operation, featuring embedded anti-islanding protection, precise voltage and frequency ride-through capabilities, and rapid reactive power support. Safety is enforced through a multi-layered defense strategy encompassing cell-level monitoring, pack-level active equalization, cabinet-level aerosol fire suppression, and container-level deflagration venting. All safety-critical functions are validated to UL 9540A test methodologies, ensuring that thermal runaway propagation is effectively mitigated and that the system presents no undue risk to personnel or grid infrastructure.

KEY FEATURES

- Standardized Interconnect Data Package: Pre-formatted technical sheets, single-line diagrams, and protection coordination studies that align with typical utility review checklists.
- Grid Code Compliance Engine: Configurable firmware settings for IEEE 1547, UL 1741 SB, and local grid operator ride-through requirements, with verifiable test reports.

- Cyber-Secure Communications: DNP3 and Modbus TCP/IP interfaces with role-based access control and encrypted telemetry, compliant with NERC CIP guidelines for grid-edge assets.
- Accelerated Approval Workflow: Template includes pre-filled forms for reactive power capability, harmonic distortion limits, and anti-islanding certification, reducing iterative utility queries.
- Full Traceability: Every component from cell to PCS is documented with UL Recognized or Listed certifications, providing a clear audit trail for the Authority Having Jurisdiction (AHJ).

COMPLIANCE & STANDARDS

The Local Grid Operator Interconnect Approval Template is built upon a foundation of globally recognized standards. The BESS cabinet and its sub-components are certified to UL 9540 (Energy Storage Systems and Equipment) and validated to UL 9540A (Test Method for Evaluating Thermal Runaway Fire Propagation). Battery modules and cells comply with UL 1973 and IEC 62619, ensuring intrinsic safety and performance reliability. The PCS is listed to UL 1741 SB and IEEE 1547.1, demonstrating full compatibility with modern grid interconnection requirements. Additionally, the system adheres to IEC 62933 for electrical energy storage systems and NFPA 855 for installation safety, providing a comprehensive compliance envelope that satisfies the most

stringent local grid operator mandates.

TECHNICAL SPECIFICATIONS

The following specification matrix represents a typical 1 MW / 2 MWh BESS configuration using the interconnect approval template. Parameters can be scaled linearly for larger deployments.

Parameter	Specification
Nominal Energy Capacity	2,150 kWh (AC) per 20-ft container
Nominal Power Rating	1,000 kW / 1,075 kVA at 25°C
DC Voltage Range	1,000 – 1,500 Vdc
AC Grid Connection	400 V / 480 V / 690 V, 3-phase, 50/60 Hz
Cell Chemistry	Tier-1 LFP (Lithium Iron Phosphate)
Cooling Method	Smart Liquid Cooling with Integrated HVAC
Round-Trip Efficiency	≥ 90% at 0.5C, including auxiliary loads
Cycle Life	≥ 6,000 cycles at 90% DoD, 25 ° C, 0.5C/0.5C
Operating Temperature	-20°C to +50°C (derated above 45°C)

Protection Rating	IP54 (Container), IP66 (PCS and Battery Cabinets)
Communication Protocols	Modbus TCP/IP, DNP3, IEC 61850 (optional)
Safety Certifications	UL 9540, UL 9540A, UL 1973, IEC 62619, CE
Grid Code Compliance	IEEE 1547, UL 1741 SB, IEC 62933
Fire Suppression	Aerosol + Perfluorohexanone (Novec 1230) dual-agent system
Dimensions (L x W x H)	6,058 mm x 2,438 mm x 2,896 mm
Weight (Approx.)	32,000 kg

INDUSTRIAL DEPLOYMENT

Deployment of the interconnect approval template is engineered for rapid integration into commercial and industrial facilities, renewable energy plants, and utility-scale microgrids. The template package includes a site-specific grid impact study outline, protection relay settings, and a commissioning test protocol that aligns with local grid operator witness testing requirements. By providing a pre-validated technical dossier, the template reduces the typical interconnect approval timeline by up to 40%, minimizes engineering rework,

and ensures that the installed BESS operates in perfect harmony with the local distribution network. This approach not only accelerates project bankability but also reinforces grid stability, resilience, and the seamless adoption of clean energy infrastructure.

