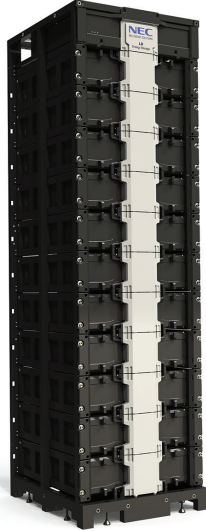


The Long Duration (LD) Energy Storage Rack from NEC Energy Solutions is a fully integrated, high energy battery storage system that provides reliable storage capacity for a wide range of long duration energy applications.



The LD Energy Storage Rack is an element of NEC Energy Solutions GBS® integrated grid-scale energy storage systems and can easily be applied as a standalone DC source for a wide range of grid and behind-the-meter (BTM) applications. The LD Energy Storage Rack is a standardized product that delivers high energy performance and inherent multi-layer safety for the most demanding energy storage scenarios.

LD Energy Storage Racks include:

- LD Battery Modules utilizing industry-proven cell technology (16 for the 700V design; 22 for the 950V design)
- An integral Battery Management System (BMS) that continuously monitors voltage, temperature, current and system conditions and performs cell balancing
- Integrated ducting for forced air cooling (as needed)
- Nested safety features providing layered protection at the cell, module, BMS, and rack level
- CAN bus communications between BMS and higher-level system controls

EXAMPLE APPLICATIONS

Distributed Energy Storage (DES)

LD Energy Storage Racks support third party systems and can be furnished in NEC's Grid Battery Storage System (GBS®) for long duration, high energy storage to enable customer energy bill management and market participation for:

- Energy Time-Shift
- Supply Capacity
- Load Following
- Area Regulation
- Reserve Capacity
- Voltage Support
- Transmission Support
- Transmission Congestion Relief
- Transmission and Distribution Upgrade Deferral
- Renewables Energy Time-Shift
- Renewables Generation Capacity Firming
- Renewables Grid Integration

LD Battery Rack Characteristics	700V LD	950V LD
Battery Type	Lithium Ion	
Nominal Voltage	700 VDC	950 VDC
Operating Voltage Range	545–750 VDC	750–1050 VDC
Max. Charge/Discharge Power	73 kW (1 full cycle/day)	100 kW (1 full cycle/day)
Continuous Charge/Discharge Power	38 kW	52 kW
Available Energy (Nominal)	75 kWh	100 kWh
Nominal Capacity	120 Ah	
Maximum Discharge Current	150 A	
Usable State of Charge (SOC)	0–100%	
Round Trip Efficiency	97% (1C), 98% (C/2)	
Cycle Life (1C charge /1C discharge, to 80% BOL @ 23°C)	>3,900 cycles (100% DOD)	
Cycle Life (1C charge /1C discharge, to 70% BOL @ 23°C)	>4,500 cycles (100% DOD)	
Operating Temperature	-40 to 60°C*	
Thermal Interface	Integrated cooling (twin top air intakes)	
Shipping/Storage Temperature Range	-40 to 60°C	
Communications	CAN bus	
DC Contactor Interlock	Yes	
Dimensions (W x D x H)	660 x 760 x 2400 mm (26 x 30.2 x 94.6 in)	
Weight	932 kg (2050 lbs)	1204 kg (2650 lbs)

* Recommended temp range for optimal battery performance is 15°C–30°C

STANDARDS AND COMPLIANCE

- EN 61000-6-2, Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
- IEC 61000-6-4, Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
- IEC 61000-6-5, Electromagnetic compatibility (EMC) - Part 6-5: Generic standards - Emission standard for industrial environments
- FCC Part 15 class "A"
- ICES 003 issue 4, Interference-Causing Equipment Standard, Digital Apparatus

- IEC 62133, Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety
- IEC 62040-1, Uninterruptible power systems (UPS)
- UL 1642, Lithium Batteries
- UL 1973, Batteries for use in Light Electric Rail (LER) and stationary applications
- UL 1778, Uninterruptible Power Systems
- NFPA 70, National Electrical Code 2011
- CAN/CSA-C22.2 No. 0 107.2-01 (R2011)

Behind-the-Meter and Off-Grid Energy Storage

Commercial, industrial and institutional organizations can apply energy storage systems equipped with LD Energy Storage Racks to reduce energy costs, reduce diesel fuel consumption, defer electrical infrastructure upgrades, enable installation or expansion of renewable energy, improve power quality and increase energy security for their facilities. The LD Energy Storage Racks are ideally suited to provide the following functions:

- Time of Use Energy management (TOU, arbitrage)
- Demand charge reduction (energy and demand charges)
- Supply firming of existing onsite renewable energy
- Generator optimization / bridge to generator during service interruptions
- Demand response management

HIGH PERFORMANCE

The LD Energy Storage Rack delivers an unparalleled combination of cycle life, calendar life and energy performance. Multi-year testing of the cells and modules, under both realistic and extreme conditions, confirms life expectancy of > 4,500 cycles.

NESTED SAFETY DESIGN

The LD Energy Storage Rack is engineered for the utmost safety, enabled by layered safety features, fusing at the cell level, module level and rack level, extensive fault monitoring at the module level and automatic opening of the dual contactors upon power loss or safety cover removal.

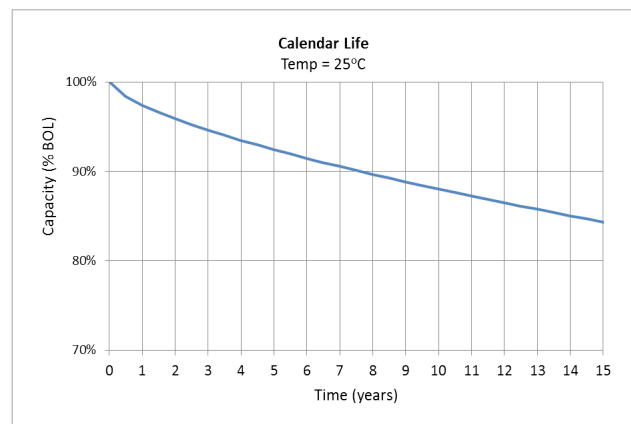
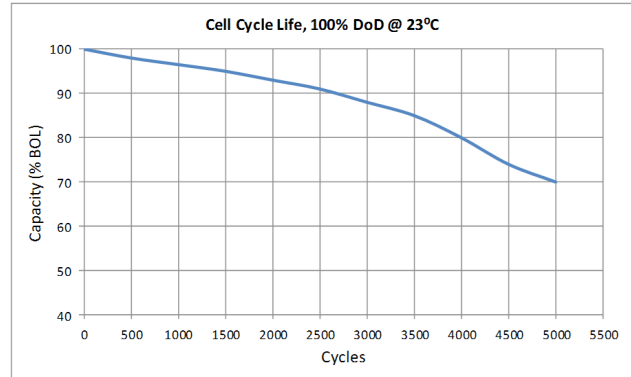
BATTERY MODULE FEATURES

LD Energy Storage Racks contain field-replaceable battery modules with on-board intelligence that communicates with the BMS to:

- Monitor voltage on every cell bank and provide independent module voltage measurements
- Measure representative cell temperatures
- Maintain cells in optimum state-of-charge and help prevent overvoltage conditions
- Monitor overvoltage conditions and signal shutdown if detected

BMS FEATURES

NEC Energy's BMS continuously monitors voltage, temperature, and current to initiate protective actions if any unsafe condition is detected. The BMS has automated independent control of two separate contactors that disconnect and de-energize an individual rack from the external DC bus if needed. These contactors mechanically default open (OFF) if the control link from the contactor to the BMS is lost, or, if auxiliary power to the BMS is interrupted. The BMS also contains a high voltage rack level fuse



to supplement contactor overcurrent protection. The BMS offers communications through a configurable CAN bus interface for integration with a larger system, as well as a separate local CAN bus interface for local diagnostics.

RACK-LEVEL FEATURES

- Supports standalone, single rack applications, or, scalable to multi-rack megawatt (MW) systems
- Integrated ducting for forced air cooling
- Patented Pre-charge and Equalizer circuits allow individual racks to be safely energized despite being at higher/lower voltage levels from adjacent racks in the system
- Safety Interlock Access Covers
- Built-in rigging/lifting points
- May be installed to Seismic Demand Spectrum (SDS) 1 or 2
- DC Bus Contactor (24V)



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