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Battery Energy Storage Systems (BESS) Operational Safety Guideline

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Electricity Engineers'
Association

Battery Energy Storage Systems (BESS) Worker Safety Guideline

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Disclaimer

This guide is recommended as good practice by electricity supply industry representatives, but it is not a substitute for legislative or other regulatory requirements. If there is uncertainty on what guidelines or legislative requirements should apply in any particular situation, specialist advice, including legal advice, should be sought.

The Electricity Engineers' Association of New Zealand (Inc.) and the electricity supply industry representatives involved in preparing this guide, accept no liability or responsibility for an error or omission contained in this guide, or any injury, loss, damage (including indirect or consequential loss or damage), or any other claim from any reliance on, or failure to rely on, the contents of this guide.

This guide has been prepared by representatives of the electricity supply industry to provide worker-safety guidance for work on or near operational BESS installations.

This guide has been prepared on the basis that the users will be appropriately trained, qualified, authorised, and competent.

Status of Examples and Case Studies

Examples, sample processes and case studies in this guide are included only to support consideration of worker health and safety matters for BESS work. They are not a complete statement of legal or regulatory requirements and do not replace site procedures, manufacturer instructions or specialist advice.

Preface

The content of this guide will be monitored and revised periodically. Suggestions for changes should be sent to admin@eea.co.nz Electricity Engineers' Association, P O Box 5324, Wellington, 6145.

Purpose

This guide provides worker-safety guidance for persons working on, operating, inspecting, maintaining, testing, isolating, responding to incidents involving, or decommissioning stationary Battery Energy Storage Systems (BESS). It focuses on the hazards workers may be exposed to, including electrical shock, stored energy, arc flash, thermal runaway, fire, explosion, toxic gas release, chemical exposure and mechanical hazards.

The aim of this document is to support safe systems of work, competent worker decision-making, effective isolation, emergency action, appropriate PPE selection and other controls when working on or near operational BESS installations.

Background

BESS installations introduce worker safety risks that differ from many conventional electrical assets because hazardous stored energy may remain present after isolation from an AC supply. Workers may also be exposed to abnormal battery conditions that can escalate quickly, including thermal runaway, fire, gas release and re-ignition.

This guide has therefore been deliberately limited to worker safety matters. Broader subjects such as asset design, public safety planning, environmental management, transport logistics, recycling processes and emergency service operational requirements are only referenced where they directly affect worker safety.

It is intended for asset owners, employers, authorised persons, supervisors and workers who need practical controls for work on or near operational stationary BESS installations in New Zealand.

Scope

This guide applies to worker safety for stationary Battery Energy Storage Systems in New Zealand where workers may be required to work on, operate, inspect, maintain, test, isolate, respond to incidents involving, or decommission the system.

It applies to work on or near operational BESS installations and associated electrical equipment where workers may be exposed to stored energy, electrical, thermal, chemical, fire, explosion, gas release, mechanical or access-related hazards.

This guide does not provide detailed design, installation, transport, environmental management, public safety, fire engineering, recycling, or emergency service operational requirements except where those matters directly affect worker safety.

Workers and employers should apply the hierarchy of control to BESS work, with priority given to eliminating or isolating hazardous energy, using engineered controls, restricting access, verifying isolation, using documented safe systems of work and selecting PPE appropriate to the task and credible failure modes.

Relevant New Zealand legislation, regulations, standards, manufacturer instructions and company procedures must be followed where they establish worker safety requirements for BESS work.

This guide complements, but does not replace, duties under applicable New Zealand legislation and regulations. It should be used as worker-safety guidance alongside site procedures, manufacturer instructions, EEA publications and the SM-EI where applicable.

Acknowledgements

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Introduction

Battery Energy Storage Systems store electrical energy for later use. For workers, the key safety issue is that a BESS may remain hazardous even when disconnected from one supply source, and abnormal battery conditions can create rapidly escalating electrical, thermal, chemical and fire risks.

However, the rapid deployment of BESS introduces new risks for workers, highlighting the crucial need for clear safety guidance.

While a BESS offers substantial benefits, it also presents significant hazards, particularly in systems using high-capacity lithium-ion batteries. These risks include fire, thermal runaway, electrical faults, chemical leaks, arc flash and mechanical damage, all of which can escalate into serious incidents that the worker may be exposed to without proper safeguards.

This guide is focused on workers who operate, maintain, inspect, test, isolate, decommission, or work near operational BESS installations.

As a worker you must:

- Use safe systems of work;
- Only perform tasks you are qualified for and have the competency to carry out;
- Take responsibility for your own health and safety obligations as well as that of other people;
- Cooperate with your employer to meet health and safety obligations and reduce risks.

This guide supports asset owners, employers, supervisors and workers to develop and apply effective worker safety procedures for BESS work.

Definitions and Abbreviations

Battery Energy Storage System (BESS)	A system consisting of batteries and associated equipment used to store electrical energy for later use. A BESS typically includes battery modules, battery management systems, inverters, protection systems, and associated control equipment.
Battery Management System (BMS)	An electronic system that monitors and manages battery operation, including voltage, current, temperature, and state of charge, and protects the battery from operating outside safe limits.
Thermal Management System (TMS)	A system used to regulate battery temperature within safe operating limits using cooling, heating, or ventilation methods.
Thermal Runaway	An uncontrolled self-heating reaction within a battery cell where increasing temperature accelerates chemical reactions, potentially leading to fire, explosion, or release of toxic gases.
ERP	Emergency Response Plan
PPE	Personal Protective Equipment
PV	Photovoltaic
UPS	Uninterruptible Power Supply

1. Worker Safety Regulatory and Standards Framework

1.1 Worker Interface with Site Safety Systems

Workers must know the location and function of BESS alarms, emergency stops, isolation points, access controls, evacuation routes and muster points before work starts.

Detection, alarm, suppression, ventilation and firefighting water systems are design matters; however, workers must understand how these systems affect safe access, evacuation, isolation, re-entry and emergency communication. Where building or fire safety systems are relied on to protect workers, their status and impairment controls should be confirmed before work proceeds.

1.2 Worker Safety Regulatory and Standards Framework

BESS work in New Zealand must be planned and carried out using the legal duties, standards, manufacturer instructions and company procedures that apply to the work task and worker exposure. The key standard for battery system installations is *AS/NZS 5139:2019*, which outlines safety requirements for battery systems used with power conversion equipment.

Electrical work on or near BESS should consider *AS/NZS 5139*, *AS/NZS 3000:2018*, relevant inverter and connection standards, the *Electricity (Safety) Regulations*, the *Health and Safety at Work Act*, *EEA publications*, *SM-EI* requirements and site electrical safety rules where applicable to worker safety.

1.3 Battery Technologies and Worker Hazard Profile

Different BESS chemistries and configurations create different worker exposures. Lithium-ion systems may present stored-energy, electric shock, arc flash, thermal runaway, fire and toxic gas risks. Flow batteries may present chemical handling, electrolyte containment and pump/pipework hazards. Workers must understand the specific technology before work starts.

The battery chemistry, battery management system, thermal management system, enclosure type, maximum DC voltage, available fault current, isolation method and emergency shutdown arrangements should be confirmed as part of the pre-work risk assessment.

1.4 Connected Generation and Other Energy Sources

Where a BESS is connected to solar PV, grid supply, generators, inverters, auxiliary supplies or other energy sources, workers must identify and control each source before work starts.

PV arrays may remain live whenever exposed to light. Workers must treat connected PV circuits as an energy source for isolation, testing, access control and emergency response purposes.

1.5 Risks and Hazards

Working with BESS involves significant hazards that require task-specific controls. Electrical risks include DC voltages capable of causing severe shock or electrocution, stored energy that may remain after disconnection, backfeed from connected equipment, and arc flash from short-circuit or switching events.

Fire and explosion risks arise from battery chemistries, particularly lithium-ion, which can undergo uncontrolled thermal runaway if damaged, overcharged, or exposed to high temperatures. This condition produces intense heat, flames, and toxic gases. Other battery types also produce flammable gases during normal operation, which can accumulate and ignite if ventilation is inadequate.

Chemical risks include exposure to corrosive or toxic electrolyte, contaminated surfaces, and gases generated during failure events. Mechanical risks include heavy modules, stored mechanical energy, dropped objects, restricted access and damaged enclosures. These risks must be considered in the task risk assessment.

1.6 Personal Protective Equipment

PPE must be selected from a task-specific risk assessment that considers electrical shock, arc flash, thermal event, toxic gas, chemical exposure and mechanical hazards. PPE may include arc-rated clothing, insulated gloves, eye and face protection, safety footwear, chemical protection and respiratory protection where justified by the risk assessment.

1.7 Signage

Signage must communicate worker-relevant hazards and controls, including BESS location, battery chemistry, maximum voltage, arc flash information where applicable, isolation points, emergency shutdown, restricted access, gas or chemical hazards and required PPE.

Hazardous substance or dangerous goods signage should be provided where required and where it supports worker recognition of battery chemistry, chemical exposure risks, emergency actions or access restrictions.

2. Energy Source Identification for BESS Work

Before work starts, workers must identify all sources that could energise BESS equipment or connected equipment, including battery strings, DC bus, AC supply, inverters, PV, auxiliary supplies, temporary generation, UPS systems, control circuits and stored mechanical or thermal energy.

Work must not proceed until isolation points are known, isolation has been applied where required, stored energy has been controlled or verified, and the work party understands any sources that cannot be fully eliminated.

2.1 Safe Access, Working Environment and Emergency Systems

For operational BESS, workers must confirm safe access and egress, restricted access controls, working clearances, lighting, ventilation, emergency shutdown access and the condition of the enclosure or battery room before work starts.

Workers must not enter or work in BESS areas where ventilation, alarms, thermal management, gas detection, emergency stops, access controls, signage or other safety-critical systems are impaired unless a specific risk assessment and additional controls have been approved.

Where PV or another generation source is connected to the BESS, it must be included in the energy source identification and isolation plan.

Safe access routes, cable protection, wildlife damage, vegetation, combustible material, water ingress and physical damage should be checked where they may affect worker safety during inspection, maintenance or emergency response.

2.2 BESS Components and Worker Safety Features

Workers should understand the worker-safety function of key BESS components, including battery modules, BMS, TMS, inverters, chargers, DC isolators, protection devices, alarms, ventilation, gas detection, emergency stops and fire protection systems.

Safety-critical features such as BMS alarms, thermal management, emergency shutdown, ventilation, protection devices and access controls must not be bypassed or defeated unless this is specifically authorised, risk assessed and controlled.

3. Safe Work Practices

3.1 Permits and Approvals

Before work on an operational BESS, workers must review the system design information, manufacturer safety instructions, site safety management plan, emergency arrangements and available operating information. A site-specific risk assessment, permit or approval process, Lock Out Tag Out (“LOTO”) plan and safe work method statement must be completed where required.

During work, workers must avoid creating sparks, short circuits or uncontrolled release of stored energy. Insulated tools, barriers, covers, test-before-touch practices and exclusion zones should be used where required. Work must stop if abnormal heat, odour, smoke, swelling, leaking, alarms, unexpected voltage, damaged components or loss of ventilation is identified.

Where general work hazards such as work at height, confined spaces, mobile plant, excavation, asbestos or hazardous substances are present during BESS work, they must be controlled under the relevant task-specific procedures. This guide does not replace those procedures.

3.2 Work on Connected Electrical Equipment

Work on equipment connected to BESS requires additional controls because the BESS may backfeed or re-energise connected conductors. Workers must verify all sources of supply, confirm the status of inverters and protection devices, and understand the operational control boundaries before work starts.

If the BESS is not under the operational control of the permit issuer, a documented assurance or interface process is required before issuing a permit or authorising work. Relevant SM-EI requirements and site procedures should be followed.

4. Worker Emergency Preparedness and Response

Workers must know the site emergency actions for alarms, abnormal battery conditions, fire, explosion, electric shock, chemical release, gas release and medical emergency. Emergency arrangements must clearly state when workers may isolate equipment, when they must withdraw, and when they must wait for authorised emergency responders or a competent person.

For suspected lithium-ion thermal events, workers should prioritise withdrawal, isolation from a safe location if authorised, exclusion zones, monitoring and emergency notification. Workers must not attempt intervention beyond their training, authorisation and available controls.

Every operational BESS site should have worker-facing emergency arrangements that are understood before work starts. These should include alarm response, evacuation routes, muster points, emergency contacts, first aid, electrical isolation arrangements, gas exposure controls and re-entry controls.

Where cooling, firefighting water, runoff control or gas monitoring is required, workers must follow the site emergency plan and directions from authorised emergency responders. Workers must avoid exposure to smoke, gases, contaminated runoff, electrolyte or fire residues unless specifically trained, authorised and equipped for the task.

After an incident, workers must not re-enter, inspect, test, repair or recommission the BESS until a competent person has confirmed that hazards have been controlled and re-entry has been authorised.

Emergency notifications and stakeholder communications should be managed under the site emergency plan. Worker-facing instructions must remain clear: withdraw, isolate only if safe and authorised, prevent entry by others, report the event and await competent assessment.

5. Worker Safety Maintenance and Inspection Checks

5.1 Arc Flash

Where applicable, perform an arc-flash risk assessment in accordance with *EEA's Arc Flash Guide* and maintain arc-rated PPE and labelling consistent with *EEA SM-EI* and site electrical safety rules.

5.2 Worker Safety Checks

Maintenance and inspection should include worker-safety checks such as enclosure condition, signage, access control, ventilation status, alarm status, BMS/TMS alarms, evidence of heat or swelling, leaks, corrosion, unusual odours, cable damage, water ingress, isolation point condition, arc flash labels and emergency equipment access.

Routine inspection intervals should be risk-based and aligned with manufacturer requirements and site procedures. Tasks must only be performed by competent workers using suitable tools, test equipment, PPE, permits and isolation controls.

All maintenance findings that could affect worker safety must be documented and escalated. Work must stop where defects indicate possible electric shock, arc flash, thermal runaway, fire, toxic gas, chemical exposure or loss of safety-critical control.

Additional task hazards such as working at height or confined spaces must be controlled under the relevant procedure where they form part of the BESS work activity.

Hazardous substances must be managed where they create a worker exposure risk during BESS inspection, maintenance, incident response or decommissioning. Broader hazardous substances storage, transport or environmental compliance requirements must be managed through the applicable specialist procedures.

6. Decommissioning Worker Safety

At the end of operational life, or when equipment is removed from service, decommissioning work must be planned to protect workers from residual stored energy, electric shock, arc flash, thermal runaway, fire, toxic gas, chemical release and manual handling hazards. Isolation and discharge status must be verified before handling battery equipment.

End-of-life, damaged, leaking, swollen, hot or suspected defective batteries must be treated as high-risk until assessed by a competent person. Workers should use appropriate PPE, containment, quarantine, lifting aids and access controls. Specialist packaging, transport, shipping and recycling requirements must be managed by competent persons under approved procedures and are outside the detailed scope of this worker-safety guide.

6.1 Movement of End-Of-Life or Damaged Batteries

Workers must not package, load, transport or ship damaged or end-of-life batteries unless they are competent, authorised and working under approved procedures. The worker-safety focus is to maintain quarantine, exclusion, labelling, information handover and exposure controls until responsibility is formally transferred.

Damaged, defective or waste batteries must be segregated, labelled, quarantined and handled in a way that prevents worker exposure to fire, re-ignition, electric shock, electrolyte release or toxic gases.

6.2 Specialist Transport Interfaces

Where batteries are handed over for road, sea or air transport, workers must follow the site handover procedure and maintain exclusion, quarantine, labelling and information controls until responsibility has been formally transferred. Detailed road, maritime or air transport compliance requirements must be managed under specialist dangerous goods procedures.

7. Worker Training and Continuous Improvement

Workers should receive training and authorisation appropriate to their role, the BESS technology, the tasks they perform and the credible failure modes they may encounter. Training should cover hazard recognition, energy source identification, isolation and LOTO, test-before-touch, abnormal condition response, emergency actions, PPE, gas or chemical exposure controls and stop-work triggers. Lessons from incidents, near misses, drills and manufacturer updates should be used to improve procedures and competency.

Appendix A References and Standards

This guideline references standards, legislation and guidance only where they support worker safety controls for BESS work. References that relate mainly to design, fire engineering, transport, environmental management or recycling are included only as background or interface references where they affect worker safety, emergency handover, exposure control or site procedures.

The primary references and standards used include:

WorkSafe Queensland	BESS safety page
Energy Safe Victoria	Bess Guidance
AS/NZS 5139:2019	Safety of battery systems
WorkSafe	Electricity (Safety) Regulations 2010 overview & 2025 amendments
Electricity (Safety) Regulations 2010 (as at 15 Jan 2026)	Regulations
Electrical installations: Safety of battery systems for use with power conversion equipment	AS/NZS 5139:2019
Australian/New Zealand Wiring Rules.	AS/NZS 3000:2018 (Wiring Rules)
Grid connection of energy systems via inverters.	AS/NZS 4777.1 & 4777.2
Stand-alone power systems.	AS/NZS 4509.1 & 4509.2
Manufacturer	Manufacturer technical manuals and safety data sheets

Appendix B SAMPLE Worker Emergency Action Card for BESS Sites

Site	Address: [Insert address]. GPS: [lat, long].
24/7 Contacts	– Incident Controller [name, mobile] – Electrical Authorised Person [name, mobile] – Asset Owner [name, mobile]
Access	– Gate reference – after-hours access method – muster points – traffic management plan reference.
Single-line diagram and isolation	– Reference drawing no. [ID] – AC/DC isolators – ESS master stop (F-Stop) location – inverter AC disconnection points
Battery system	– Technology/chemistry – total energy (MWh) and max DC voltage – enclosure type (container/room) and ventilation method
Worker emergency actions	– Withdraw to a safe location, prevent unauthorised entry, notify emergency responders and isolate only from a safe location if authorised. – Do not attempt firefighting, cooling or re-entry unless specifically trained, authorised and equipped under the site emergency plan. – Provide information to emergency responders about battery chemistry, isolation points, alarms, access restrictions and known hazards.
Worker gas/toxic exposure controls	– Monitor HF, HCN and CO only where trained, authorised and equipped to do so under the site emergency plan. – Establish or maintain worker exclusion zones, stay upwind where practicable and prevent unauthorised access. – Avoid contact with contaminated runoff, electrolyte, smoke residues or fire debris and follow the site emergency plan.
Emergency responder handover information	– Make site access, hydrant, water supply, hardstand and isolation information available to emergency responders where relevant to safe handover and worker exclusion controls.
Re-ignition watch	– Re-entry, inspection, testing or recommissioning must not occur until a competent person has confirmed hazards are controlled and re-entry has been authorised.
Worker communications and notifications	– Notify FENZ where required by the site emergency plan. – Notify Police where traffic or public access controls are required by the site emergency plan. – Notify WorkSafe or other regulators where required by legal or company notification procedures. – Notify the network operator where required for isolation, backfeed, export or site access controls.