Victorian neighbourhood battery safety

November 2024

Guideline

About this guideline

This guideline sets out the legal requirements for installing neighbourhood batteries (also known as 'community batteries'), the hazards and risks associated with neighbourhood batteries and the controls that should be considered to ensure their safe design, installation and operation. This guideline applies to neighbourhood batteries that have a generation capacity of less than 1 megawatt (MW).

Who is this guideline for?

This guideline is for any person or entity involved with neighbourhood batteries, including owners, designers, installers and operators of neighbourhood batteries.

Owners: Entities or individuals who own or finance the neighbourhood battery system. Owners may include:

- community organisations
- local councils
- distribution network service providers (DNSP)
- private individuals.

Throughout the lifecycle of the neighbourhood battery system, owners may engage:

- designers
- installers
- operators
- maintenance contractors.

Owners bear the ultimate responsibility for compliance, safety and adherence to regulatory requirements.

Designers: Professionals engaged in conceptualisation and planning of the neighbourhood battery system – including the detailed design. This includes those responsible for structural, electrical and safety design aspects.

Installers: Licensed electrical workers responsible for the physical implementation of the neighbourhood battery system. This includes the configuration, testing and commissioning of the installation.

Operators: Individuals or teams responsible for the day-to-day tasks of the neighbourhood battery system – management, monitoring and maintenance. This includes those overseeing the operation, ongoing safety and efficiency of the system.

Summary

Neighbourhood batteries may also be called mid-scale network connected battery systems and are connected to the electricity supply networks. They typically have a storage capacity between 100 kWh and 5 megawatt hours (MWh).

Neighbourhood batteries may pose serious safety risks – including electric shock, arc flash, fire or explosion. They must be appropriately designed, installed and maintained to reduce these risks.

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Owners, designers, installers and operators should ensure their neighbourhood batteries are safe by:

- conducting a risk assessment during the design phase – and plan to remove, or implement controls to minimise, any hazards or risks to people or property
- selecting electrical equipment that is appropriate for the location
- selecting electrical equipment that complies with the relevant product standards
- selecting electrical equipment that ensures the battery system is safe to be connected to an electricity supply
- ensuring licensed electrical workers do the installation work
- regularly monitoring, testing and maintaining the installation – ensuring it remains in good working order and is safe, and identifying any new hazards or risks.

Factors that can contribute to battery installation failures include:

- installation in inappropriate locations
- electrical overloads
- fires
- worker installation or operation errors
- vehicle collisions
- equipment not suitable for local environmental conditions.

Legal requirements for neighbourhood batteries

The *Electricity Safety Act 1998* (Act) sets out the requirements for electrical installation work.

The Act requires those carrying out electrical installation work ensure the quality of materials, fittings and apparatus used – and the methods followed – comply with the *Electricity Safety (General) Regulations 2019* (Regulations)[1].

The Act requires anyone installing electrical equipment to take reasonable care to ensure that the electrical equipment is safe to be connected to an electricity supply[2].

The Act and the Regulations require the person responsible for the electrical installation work to:

- verify that the electrical installation complies with the Act and the Regulations[3].
- issue a Certificate of Electrical Safety upon completion of the work to the owner[3].
- arrange for a Licensed Electrical Inspector to inspect and certify the electrical installation – before it's energised.[4]

The Act also requires that a person must not supply – or offer to supply – electrical equipment unless the electrical equipment satisfies its relevant prescribed standard[5]. It must also be safe to connect the electrical equipment to an electricity supply[5] .

For more information refer to selling appliances and equipment.

Non-compliance

If we determine that a neighbourhood battery is unsafe, we may:

- issue directions to the relevant electricity distribution company to disconnect electricity supply to the neighbourhood battery
- require the owner or other responsible person to do any other thing necessary to make it safe

[1] Electricity Safety Act 1998, s.42

[2] Electricity Safety Act 1998, s.43

[3] Electricity Safety Act 1998, s.44

[4] Electricity Safety Act 1998, s.45

[5] Electricity Safety Act 1998, s.54

- take other enforcement action, including prosecution in certain circumstances.

For more information, read our Compliance and Enforcement Policy.

Safe design

The design phase is crucial. This is when we expect hazards and risks to be identified – and assessed – to eliminate or minimise, as far as is practicable, the hazards and risks to people and property.

What is practicable will depend on the circumstances, having regard to:

- the severity of the hazard or risk in question
- the state of knowledge about the hazard or risk and the ways of removing or mitigating the hazard or risk
- the availability and suitability of ways to remove or mitigate the hazard or risk
- the cost of removing or mitigating the hazard or risk.

Safety in design process

We expect a Safety in Design (SiD) process to be adopted for neighbourhood battery design.

SiD provides a formally documented process demonstrating systematic risk management. It's critical in identifying and eliminating or controlling hazards and risks.

The SiD should consider the entire lifecycle of the battery system or installation, including:

- construction
- commissioning
- operation
- maintenance
- decommissioning.

Safe design ensures hazards are identified early in the design process. This allows responsible parties to implement control measures to reduce risk.

Hazards and risks workshop

The SiD process should include a workshop with a range of stakeholders. This is where hazards and risks are identified and assessed. The workshop should include stakeholders relevant to the lifecycle stage under assessment. For example, include electrical workers when considering the construction and commissioning phase.

People involved in the actual tasks are critical in the SiD workshop. They provide invaluable insights into the hazards associated with the work.

The output from the SiD workshop is a detailed risk register. The risk register should contain the following information:

- lifecycle stage (construction, commissioning, operation, maintenance and decommissioning)
- hazards identified at each stage of the lifecycle and identified risk being managed
- existing control measures for each identified risk
- assessment of consequence and likelihood of each hazard
- identification of potential control measures that can be implemented
- decision and justification for the implementation or rejection of potential control measures
- residual risk remaining once potential control measures are implemented
- person or party responsible for the implementation of identified controls.

SiD report

We expect that a detailed SiD report be produced and it should include the risk register as an appendix. We expect the report to include the methods and investigations applied to the risk assessment. The report should identify the controls and how they will be implemented in practice.

Equipment/component selection

When selecting equipment for a neighbourhood battery, consider local environmental factors. For example, wind speed and ambient temperature. Selected equipment should be designed and tested to operate within local conditions. Selected equipment must be compliant with relevant Australian Standards such as AS/NZS 5139 and AS/NZS 4777.

Location of installation

Neighbourhood battery designers must consider many factors when selecting a location for battery installation.

It's important to consider proximity to other services, such as overhead powerlines and underground services. Other factors include access and egress to the battery, ventilation for the battery and access for emergency services' vehicles.

The propensity for natural disasters, such as bushfires and floods near the proposed site of the battery, should be considered where appropriate.

Underground services

Prior to any ground penetration, obtain a site plan from Before You Dig Australia. Before You Dig Australia is a free service. It provides details about underground services such as pipelines and cables in the area. For more information regarding undertaking work near underground services, refer to the WorkSafe Victoria Guidebook.

Overhead powerlines

Building near overhead powerlines requires consideration of energy safety requirements. Regulation 610[6] sets out minimum distances required between structures and overhead power lines.

There's an inherent safety risk in building near overhead power lines. It's an offence to breach the minimum clearance distances prescribed in Part 6 of the Regulations[7].

When working in the vicinity of overhead powerlines, you must adhere to rules for No Go Zones (NGZ).

NGZ rules describe minimum safety requirements. The requirements are based on the distance between overhead powerlines and the work being performed. If this is unavoidable, prior consent must be obtained from the relevant electricity distribution company. Controls must be put in place to reduce risk – such as de-energising and isolating the line during works that encroach the NGZ.

Failure to consider overhead powerlines can have costly and potentially fatal consequences.

An exemption is required to install electric lines on public land under the requirements of Section 47 of the Act. For more information, refer to our website's information about Exemptions.

[6] Regulation 610, Electricity Safety (General) Regulations 2019

[7] Electricity Safety (General) Regulations 2019

Bushfire mitigation

Consideration also needs to be given to the mitigation of bushfire risk.

Where possible, neighbourhood batteries should be located in areas outside the Bushfire Management Overlay and the risk of fire propagation to, and from, the battery is low.

The characteristics of vegetation at the proposed location need to be assessed. This will influence the intensity and spread of a bushfire. Areas with overhanging trees and dense vegetation should be avoided.

Vehicle crash

A vehicle crashing into the battery installation can result in catastrophic failure. This creates safety hazards for people and nearby properties and infrastructure.

Where possible, select a location that won't present the risk of vehicle contact.

Where this is unavoidable, control measures should be put in place – such as barriers or bollards. When selecting barriers or bollards, consider factors specific to the location. For example, the speed limit and types of vehicles on the road.

Battery enclosure

Neighbourhood battery enclosures are panels or cabinets housing battery systems. They should be suitably rated for their intended use. Battery enclosures that are not suitably rated present health and safety risks to people in the vicinity of the enclosure.

The enclosure should be rated to contain or vent an internal fault. Available fault current and arc flash incident energies need to be considered for an appropriately rated enclosure.

- You should give preference to arc-fault contained/vented enclosures. This reduces risk to people resulting from an internal fault.
- You should design venting in a way that doesn't present risk to people near the enclosure.

Access to the inside of the enclosure should be restricted to qualified personnel engaged to undertake works.

Public access should be restricted by locking panel doors. And design and material selection of the enclosure should consider vandalism or malicious acts. If required, there should be prominent warning signs displayed to warn about the dangers of entering the enclosure.

The enclosure should have a suitable Ingress Protection rating – in accordance with AS 60529, that provides a degree of protection or sealing effectiveness against water, vermin and dust.

Battery chemistry

Battery technology is constantly evolving with different chemical characteristics. It is crucial to assess the risks and hazards associated with each type of battery. This is how you can best determine the most suitable choice for your project.

Each chemistry presents unique risks, such as:

- thermal runaway
- toxic chemical release
- corrosive chemicals
- fire hazards.

Fire prevention and detection

Fire prevention control measures – in conjunction with fire suppression control measures – will reduce the likelihood or impact of a fire event.

A fire event can lead to property, environmental and equipment damage. A fire event also presents a risk to people's health and safety. A battery fire can result in the release of toxic chemicals.

Battery manufacturers should provide information about:

- potential hazardous gases that could be released from their batteries in a fire
- inhalation hazards
- any hazards that may be generated while fighting the fire.

Controls should be put in place to mitigate the associated risks.

Fire authority consultation

It's essential to consult with your relevant fire authority about your neighbourhood battery system. Do this as early as possible in the process. Contact the Country Fire Authority (CFA) or Fire Rescue Victoria (FRV).

To determine which fire authority is relevant to your installation's location, use Mapshare.

Consultation should be ongoing throughout the lifecycle of the neighbourhood battery system.

Fire authorities can provide insight and guidance into fire risk and emergency planning. You should develop an emergency response plan in consultation with the fire authority. Include the procedures and firefighting methods for emergency responders to use when responding to a fire.

Fire controls

Fire detection, control and suppression measures should be in place.

Fire detection sensors – such as heat (thermal), fire, smoke and gas sensors can alert local fire authorities that a fire has occurred at the location.

The battery system should have controls in place to prevent fire propagation. This protects nearby equipment, properties and other flammable objects such as vegetation.

Consider locating the battery installation in an area with a non-flammable surface, for example concrete. Use of fire modelling provides better understanding about the potential for fire propagation.

Fire control and prevention of fire propagation are the key elements that should be addressed when assessing fire suppression control measures.

Examples of other control measures include:

- buffer zones around the battery
- fire walls
- vegetation management in the proximity of the battery.

Monitoring and protection

Robust monitoring and protection measures ensure the safe operation of a neighbourhood battery system. You should design your neighbourhood battery with systems that cover aspects such as:

- battery management systems
- electrical protection
- earthing
- safeguards for external factors – for example, lightning strikes.

These systems are designed to reduce the likelihood of failure and enhance overall safety.

Battery management system

The battery equipment should be designed with an internal battery management system. These systems ensure battery operation within the manufacturer's specified safe operating limits – and control the battery's operation to prevent it operating outside those limits.

These systems are designed by the manufacturer. If the SiD identifies that they are required, the designer of the system should confirm that they are included.

The management system can monitor the individual battery's':

- temperature
- voltage
- impedance, and

identify when an abnormal condition occurs that could lead to thermal runaway or fire.

You can use other controls in conjunction with a management system to prevent the spread of heat or fire within the battery system. These include:

- thermal imaging sensors
- thermal barriers
- isolation systems
- shutdown separators.

Levels of management systems

There are different levels of management systems, including:

- the battery management system at the module level as described above
- the management system at the installation level
- the cloud-based energy management system at the highest level.

Monitoring and prevention need to be carried out at all 3 levels of system management. This ensures alerts can rapidly lead to isolation and human intervention.

Electrical protection

Electrical protection is used to disconnect the battery system from the network in the instance of a fault or failure. This protects both the electricity network and the neighbourhood battery.

The DNSP may have specific protection requirements. Engage the DNSP early to identify these requirements. DNSP protection requirements will relate to protecting the electricity network under fault – and isolating the battery from the network.

The protection associated with protecting the battery is the responsibility of the designer. The designer should ensure the protection is adequate to disconnect under all fault scenarios and avoid damage to the equipment. AS/NZS 3000 outlines some of the protection requirements designers should follow.

It is the designer's responsibility to ensure the earthing system is adequate. The earthing system protects equipment and personnel under fault conditions. An earthing study should be undertaken to determine the requirements.

Depending on the type of configuration, earthing of the battery may be required. The earthing requirements of the battery system can be affected by the direct current (DC) voltage level and the topology of the inverter. A protection device or system capable of detecting an earth fault should be installed.

Protection settings are dependent on the configuration of the equipment. You need to consider the available fault current from the network as well as the fault current from the battery system. A coordination study may be required to grade the protection with upstream protection devices.

Protection devices should protect against risks such as, but not limited to:

- DC overcurrent and DC overvoltage
- alternating current (AC) overcurrent and AC over-voltage
- power supply under-voltage
- AC frequency and over-temperature
- earth leakage or residual current monitoring.

Lightning strikes

Lightning protection should be designed, installed, maintained and tested according to AS 1768. Lightning strikes can cause damage to structures. This can lead to transient over-voltages that can cause damage to electronics. Surge protection can protect equipment under these conditions. Consider these factors when selecting equipment and the location of the battery system.

Maintenance

The battery system should have an appropriate monitoring system. The system should be maintained according to the manufacturer's recommendations and specifications. This ensures the battery system's safe, efficient and reliable operation. It also ensures early detection of failures.

Qualified personnel should undertake maintenance. They should be familiar with the equipment and maintenance requirements. Examples of qualified personnel include specialised maintenance contractors or the manufacturer's maintenance personnel.

Depending on the manufacturer's specifications, the required maintenance may include:

- visual inspections
- thermal imaging
- firmware updates to the battery management system
- verifications of thermal and fire systems
- verification of protection devices
- testing of equipment/components.

Hazards and risks

Table 1 sets out hazards associated with a neighbourhood battery system. It includes risk sources and examples of controls that can be used to mitigate risks.

Table 1 is not an exhaustive list. It does not limit the responsibility of owners. Owners must ensure they meet their obligations under the Act and the Regulations.

Risk management is an ongoing process. Owners of a neighbourhood battery system should review the control measures regularly. This ensures risks are being controlled as far as practicable.

Risk controls should be reviewed and updated if there are any changes to the installation or to the surrounding environment.

Hazard/risk	Source	Controls
Electric shock	Contact with live parts	No live work Designed to AS/NZS 3000 requirements AC/DC isolation points Lock-out tag-out procedure
Arc flash	Cable or equipment failure Switching of circuits Ingress of foreign materials	Arc flash study to determine Incident energies and boundaries Only interact with de-energised equipment Arc fault contained/vented enclosure Arc flash protection devices Arc rated personal protective equipment is used. Remote operation of equipment
Ingress of water, fauna and flora	Enclosure not specified with correct IP rating Ingress points not sealed	Suitable IP rating of equipment Pest and vermin controls Sealed ingress points Regular inspections and maintenance
Thermal runaway	Thermal properties of battery No mitigating system Battery management system not functioning Overcharging	Suitable battery chemistry Off-gas detection Safety in design process Battery management system tested, and functionality verified
Fire propagation	Thermal runaway Poor design Inadequate spacing of equipment Location of equipment Proximity to dwellings	Fire suppression systems Safety in design process Equipment located in location away from flammable material and dwellings Equipment spacing assessed and designed accordingly Consultation with fire authority Local firefighting resource
Equipment fault / failure	Poor maintenance No system monitoring Manufacturing flaw Lightning strike	Use of qualified installation personnel Regular maintenance Battery management system Quality control and quality assurance Lightning protection
Protection maloperation	Incorrect settings Functionality not verified	Testing and commissioning to manufactures specifications Protection study and coordination Insulation coordination study Regular maintenance
Vandalism damage	Unauthorised access	CCTV or regular patrols Security system

Table 1 – Example hazards and controls

Hazard/risk	Source	Controls
Mechanical damage	Struck by vehicle Damaged in transport	Placed in a location away from vehicle movement Protective barriers or bollards Equipment inspected and tested on-site Quality control and quality assurance
Bushfire or grassfire	Failure leading to a fire	Located in an urban environment, away from dense vegetation and overhanging trees. Clear vegetation around installation in higher risk areas. Regular maintenance Ember protection Fire studies

Table 1 – Example hazards and controls *continued*

Further information

We encourage owners, designers, installers and operators to engage with us. Contact our renewable energy team at renewable.energy@energysafe.vic.gov.au.

- Neighbourhood battery tools and resources (DEECA)
- Design Guidelines and Model Requirements for Renewable Energy Facilities (CFA)
- Arc flash hazard management (Energy Safe)
- Best Practice Guide: Battery Storage Equipment

References

AS/NZS 3000 Electrical installations (Known as the Australian/New Zealand Wiring Rules)

AS/NZS 5139 Electrical installations – Safety of battery systems for use with power conversion equipment

AS/NZS 4777 – Grid connection of energy system via inverter

AS 1768 – Lightning Protection

AS 60529 – Degrees of protection provided by enclosures (IP Code)

AS 60529 – Low-voltage switchgear and control gear assemblies

IEC 62932-1:2020: Flow battery energy systems for stationary applications - Part 1: Terminology and general aspects

IEC 62933-1:2018: Electrical energy storage (EES) systems - Part 1: Vocabulary

IEC 62933-2-1:2017: Electrical energy storage (EES) systems - Part 2-1: Unit parameters and testing methods - General specification

IEC TS 62933-2-2:2022: Electrical energy storage (EES) systems - Part 2-2: Unit parameters and testing methods - Application and performance testing

IEC TS 62933-3-1:2018: Electrical energy storage (EES) systems - Part 3-1: Planning and performance assessment of electrical energy storage systems - General specification

IEC TS 62933-4-1:2017: Electrical energy storage (EES) systems - Part 4-1: Guidance on environmental issues - General specification

IEC TS 62933-5-1:2017: Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification

IEC 62933-5-2:2020: Electrical energy storage (EES) systems - Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-based systems

IEC 63056:2020: 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

IEC TR 61850-90-9:2020 Communication networks and systems for power utility automation - Part 90-9: Use of IEC 61850 for Electrical Energy Storage Systems

Who we are

We are Victoria's safety regulator for electricity, gas and pipelines.

We ensure Victorian gas and electricity industries are safe and meet community expectations. We also license and register electricians and educate the community about energy safety.

Find more information on our website: https://www.energysafe.vic.gov.au/