



ADVICE ON AS/NZS 5139:2019

Version 1, May 2020

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IMPORTANT INFORMATION ABOUT THIS ADVICE DOCUMENT

This advice document has been prepared by the Clean Energy Council (CEC) to help accredited designers and installers understand and interpret AS/NZS 5139:2019 - *Safety of Battery systems for use with power conversion equipment*. This advice alone does not constitute a fully definitive set of rules and should be read in conjunction with existing relevant standards, codes, and network service provider rules.

While all care has been taken to ensure this advice is free from omission and error, no responsibility can be taken for the use of this information in the installation of any battery energy storage system.

The CEC encourage the industry to provide feedback and/or requests for additional clarification requirements. This can be done using the online form at cleanenergycouncil.org.au/technical-advice-feedback.

1 INTRODUCTION AND SCOPE

1.1 General

The objective of this advice is to:

- assist accredited persons in the interpretation of AS/NZS 5139:2019,
- improve the safety, performance and reliability of energy storage systems installed in the field,
- encourage industry best practice for all design and installation work.

The performance of a reliable installation that fulfils system owner expectations requires both careful design and correct installation practice.

Further tools to assist you to interpret the standard can be accessed via the installer login section of the website at cleanenergycouncil.org.au/account/resources/battery-technical-information.

About your accreditation

Central to the Clean Energy Council's (CEC) work is the Accreditation program.

CEC accreditation, depending on the category held, validates an individual's knowledge and skills in the design and/or installation of:

- grid-connected solar PV systems
- stand-alone solar PV systems
- grid-connected battery storage

Being an accredited person with the CEC makes you eligible to participate in government incentive schemes like the Small-Scale Renewable Energy Scheme (SRES) and others. Part of the CEC's roll is to foster and assist in the growth of the renewable energy industry in Australia. It can only continue to grow if we maintain a high standard of quality and of personal, public and electrical safety.

Every accredited person has their part to play. After becoming accredited with the CEC, an accredited person is required to only work within the scope of the accreditation held by the accredited person as outlined in the CEC's Accreditation Terms and Conditions.

An accredited person must follow all requirements in the relevant Australian standards and Clean Energy Council guidelines. Where a CEC-accredited person is found not to comply with all the relevant Australian standards and CEC guidelines, the accredited person will be required to go through the CEC compliance process where they could be issued with demerit points, asked to perform rectification work, asked to prove their competency and even have their CEC accreditation suspended or cancelled.

A copy of the CEC's Accreditation Terms and Conditions, compliance process and CPD information can be found online at cleanenergycouncil.org.au/industry/installers/compliance-toolkit.

1.2 Scope

This advice document does not go beyond the scope of AS/NZS 5139 as outlined in clause 1.1.1

AS/NZS 5139 is written differently to other electrical installation standards. This is because there are many types of battery energy storage technologies available and each one has specific risks associated with it.

If AS/NZS 5139 stated requirements for all batteries based on those with the most extreme risks, the standard would be too strict and limit the number of batteries able to be installed.

However, if AS/NZS 5139 only considered the batteries with the lowest risk and based the rules around these batteries, there may be some instances where the community could be put at risk.

In order to draw a line between ‘fair’ and ‘safe’, AS/NZS 5139 splits batteries into three categories so that there can be different requirements for each category. The categories are linked to the [Best Practice Guide: battery storage equipment — Electrical Safety Requirements](#), explained further in section 2.2

1.3 Application

This advice document has been written to align with sections of AS/NZS 5139:2019 to assist accredited persons interpret the standard.

Note: AS/NZS 5139 supersedes AS 4086.2-1997 - *Secondary batteries for use with stand-alone systems – Installation and Maintenance*. Battery installations for stand-alone power systems shall now follow the requirements in AS/NZS 5139. This includes lead-acid battery banks.

1.4 Definitions

Throughout this guideline, the following definitions and those of AS/NZS 3000 apply.

Accredited person– Throughout this advice document, refers to someone who holds any type of CEC battery storage accreditation.

Approved batteries - Throughout this guideline refers to a battery or energy storage device listed on the [CEC’s Approved Energy Storage Devices \(Approved Batteries\) list](#) under the [Battery Assurance program](#). The list is a list of lithium-based energy storage devices that meet industry best practice requirements and is based on conformity to the Battery Best Practice guide (see below).

Note: There may be other batteries that have been tested to the BPG but do not appear on the CEC’s Approved Energy Storage Devices list. The CEC cannot comment on the suitability of these products, and it is up to the accredited persons to ensure they meet the requirements of the Battery BPG.

Battery Best Practice Guide (Battery BPG) – the *Best Practice Guide: Battery Storage Equipment Electrical Safety Requirements*. This guide provides a detailed set of requirements for manufacturers

Pre-assembled integrated battery energy storage system (BESS) – a battery energy storage system manufactured as a complete integrated package with the PCE, one or more cells, modules or battery system, protection devices, power conditioning equipment and any other required components as determined by the equipment manufacturer. Pre-assembled integrated battery energy storage system equipment is supplied in a dedicated enclosure and is AC coupled to the rest of the electrical installation.

Section 4 – BESS – a pre-assembled integrated battery energy storage system, which conforms to the Battery BPG and is included on the CEC’s Approved Batteries list. The installation requirements in section 4 of AS/NZS 5139 apply to this type of battery.

Pre-assembled battery system (BS) – a system comprising one or more cells, modules or battery system, and auxiliary supporting equipment such as a battery management system and protective devices and any other required components as determined by the equipment manufacturer. Under the BPG definitions, a pre-assembled battery system does not include an inverter.

Pre-assembled battery system equipment comes in a dedicated enclosure. The equipment is a complete package for connection to a DC bus, or DC input of a PCE (such as a multi-mode inverter).

Section 5 – BS – a pre-assembled battery system, which conforms to the Battery BPG and is included on the CEC's Approved Batteries list. The installation requirements in section 5 of AS/NZS 5139 apply to this type of battery.

Section 6 – other batteries – all batteries or battery systems that ***do not conform to*** the Battery Best Practice Guide. The installation requirements in section 6 of AS/NZS 5139 apply to this type of battery.

Note: AS/NZS 5139 section 6 will not be covered in this version of the advice document.



2 SYSTEM CONFIGURATIONS

CEC-accredited persons who are installing energy storage devices should have access to the following standards, codes and guides when reading this document. This advice is designed to be read in conjunction with the documents listed below.

2.1 General

CEC-accredited persons shall comply with the current versions of the following standards:

AS/NZS 3000	Wiring rules
AS/NZS 5033	Installation and safety requirements for photovoltaic (PV) arrays
AS/NZS 4777.1	Grid connection of energy systems via inverters. Part 1: Installation requirements
AS/NZS 4777.2	Grid connection of energy systems via inverters. Part 2: Inverter requirements
AS/NZS 4509.1	Stand-alone power systems. Part 1: Safety and installation
AS/NZS 4509.2	Stand-alone power systems. Part 2: System design
AS/NZS 3010	Electrical installations – generating sets

The system shall also comply with the relevant electrical service and installation rules (SIRs) for the state or territory where the system is installed.

The network service provider (NSP) may have additional requirements, including provision of documentation to enable connection to the grid.

Note: AS/NZS 5139 clause 1.1.2 says that battery systems shall be installed in accordance with AS/NZS 3000 except as varied within AS/NZS 5139.

Note: AS/NZS 5139 also requires installers to follow manufacturer's instructions. Installers should ensure they have these during the design stage and on site for installation.

The following four simplified block diagrams show both a grid-connected solar (figure 2.1.1), grid-connected solar and storage installation (figure 2.1.2 and 2.1.3), and a stand-alone installation (figure 2.1.4). The coloured dotted outlines show which standards apply to which parts of the installation.

Note: The following diagrams are a representation of most clauses within the standards. However there are instances where clauses apply outside of these borders that were too difficult to be represented graphically. Additional diagrams will be added into future versions of this document.

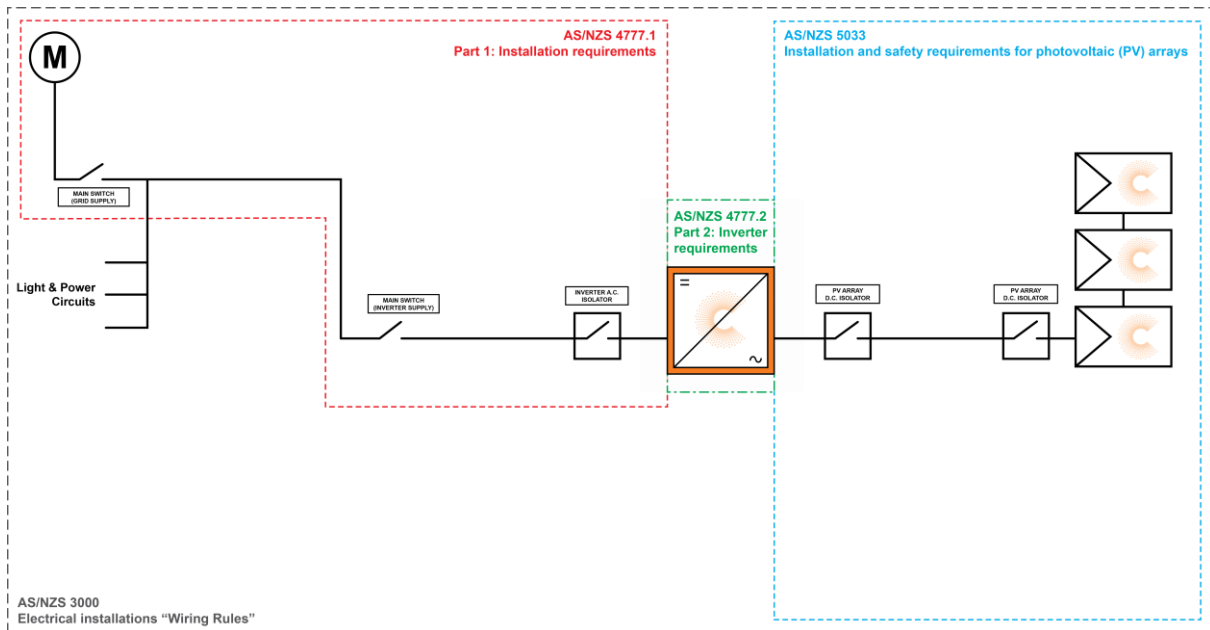


Figure 2.1.1 – application of standards related to a grid connected solar PV system

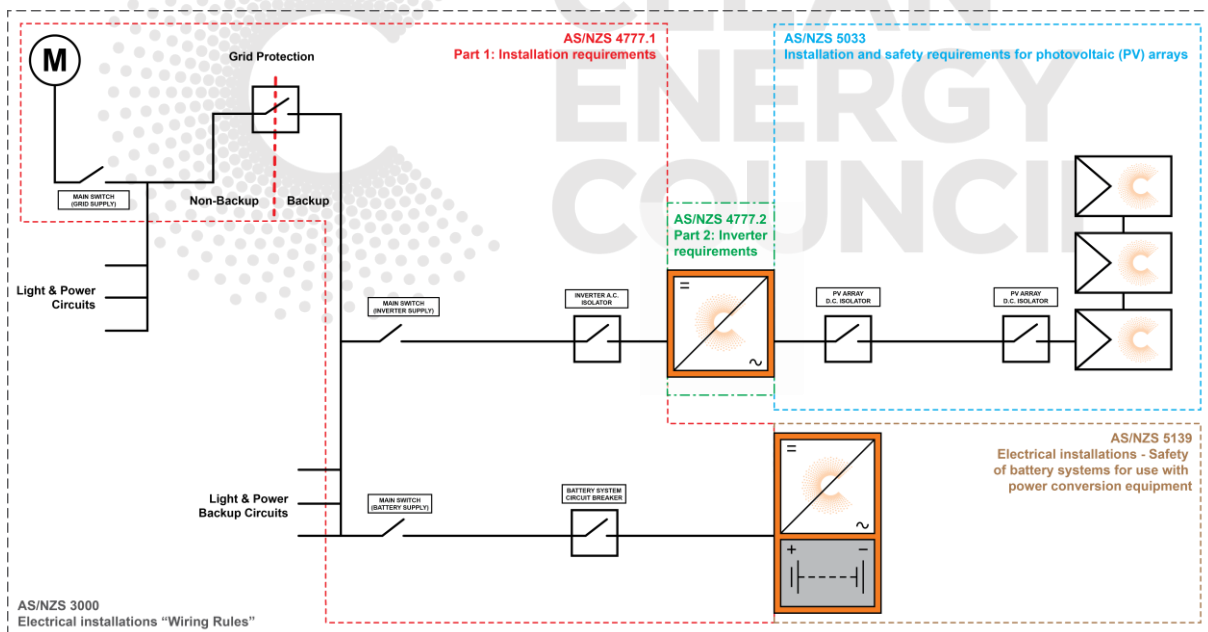


Figure 2.1.2 – application of standards related to a grid connected battery system.

This example uses a section 4 – BESS

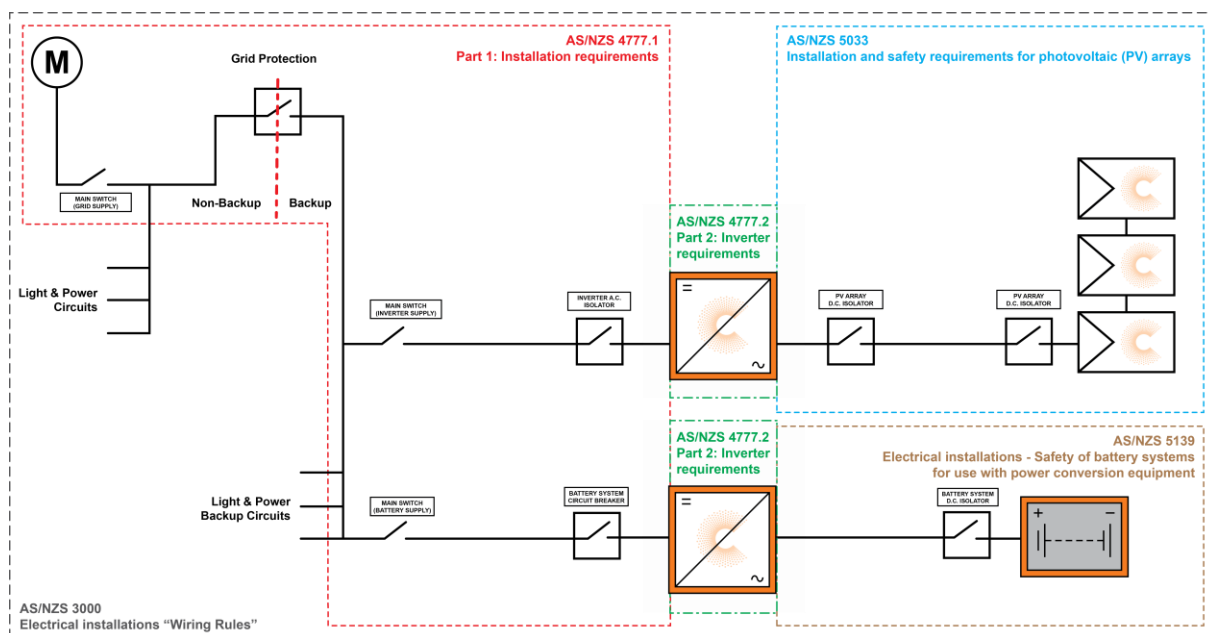


Figure 2.1.3 – application of standards related to a grid connected battery system.
This example uses a section 5 – BS.

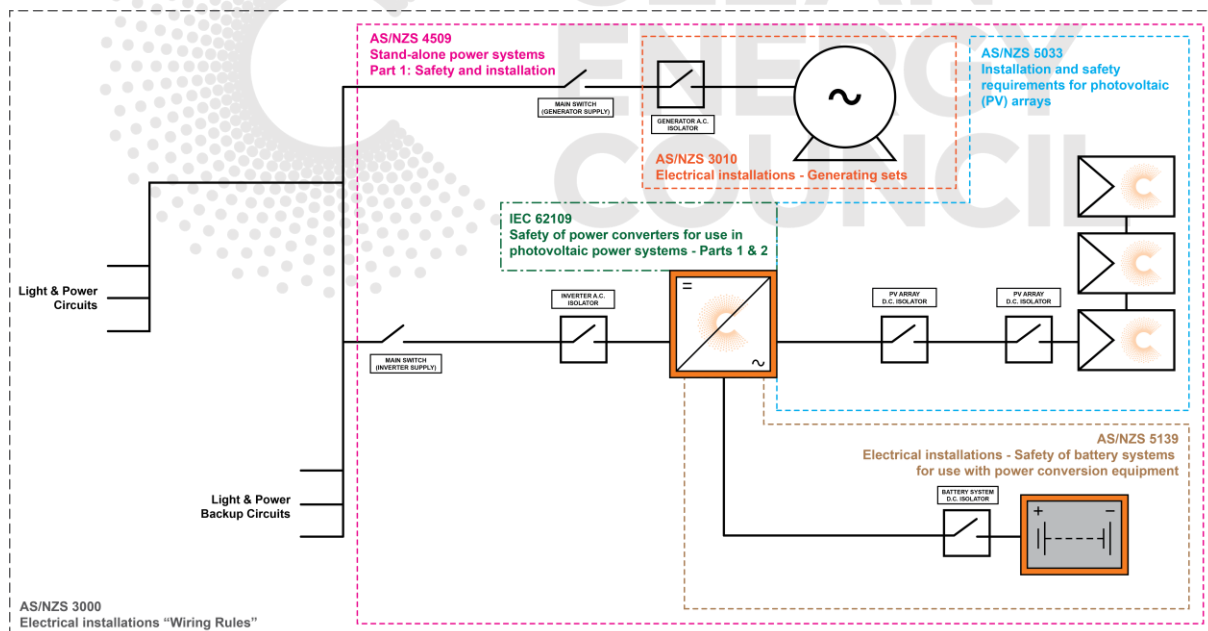
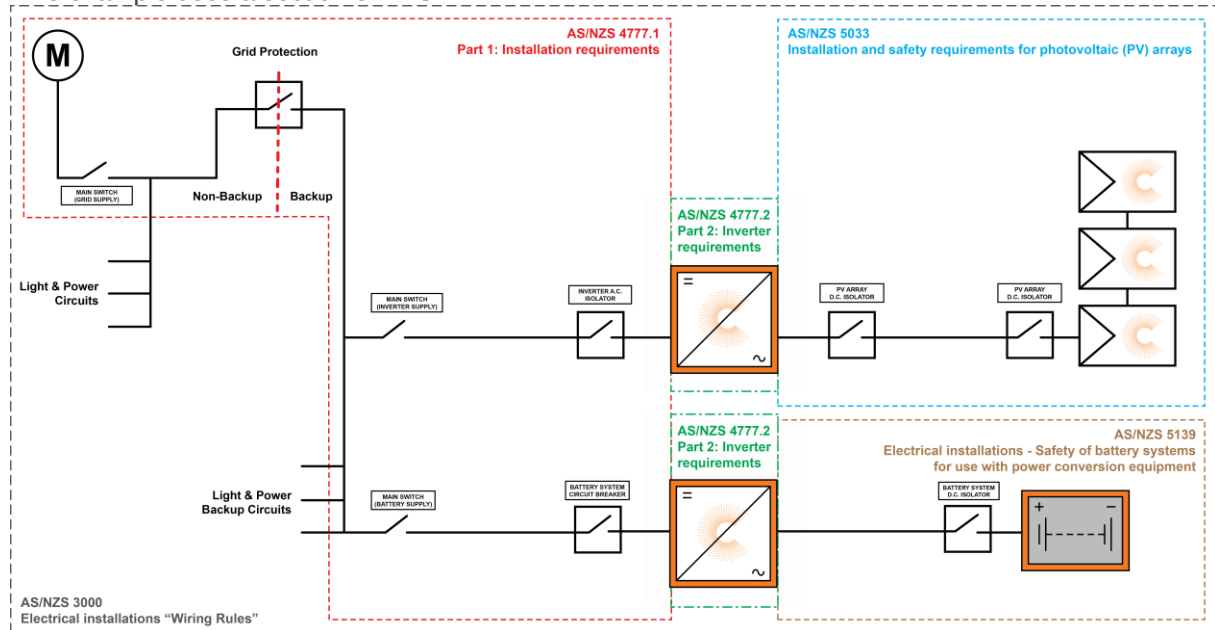


Figure 2.1.4 – application of standards related to a stand alone power system.

This example uses a section 5 – BS.



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2.1.1 National Construction Code

The *National Construction Code* (NCC) is a performance-based code containing all performance requirements for the construction of buildings. It is split into three sections:

- NCC 2019 volume one – contains the requirements for multi-residential, commercial, industrial and public buildings and structures.
- NCC 2019 volume two – contains the requirements for residential and non-habitable buildings and structures.
- NCC 2019 volume three – contains the requirements for plumbing and drainage for all classes of buildings.

Readers of AS/NZS 5139 will need to understand parts of volume 1 and 2 of the NCC predominately for the classifications of buildings, habitable rooms and some definitions.

This document will reference the NCC. It can be downloaded for free from ncc.abcb.gov.au

2.1.2 Best Practice Guide – Battery Storage Equipment

The *Best Practice Guide: Battery Storage Equipment* (Battery BPG) has been developed by industry as a set of minimum standards for lithium ion battery products.

Although the Battery BPG is not technically a product standard, batteries that have met its requirements have proven that many potential hazards have been mitigated against by the manufacturing process so do not need to be re-considered during the installation process.

The Battery BPG is a publicly available document. It can be downloaded of free from batterysafetyguide.com.au/

2.2 Battery categories

AS/NZS 5139, section 2 gives examples of various battery configurations in more detail but for simplification see figure 2.2.1 for the main battery categories CEC-accredited persons need to understand.

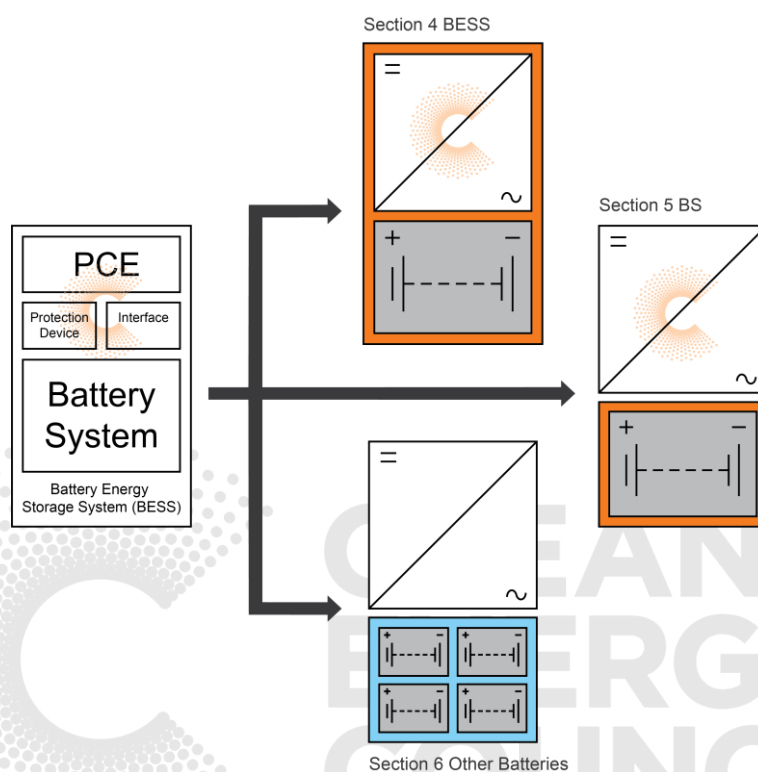


Figure 2.2.1 – battery categories as referenced in CEC advice

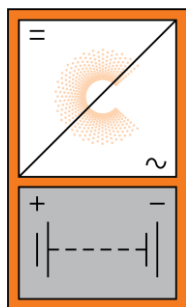
The CEC Approved Battery list is a list of lithium-based energy storage devices that meet industry best practice requirements and is based on compliance to the Battery BPG. To browse the CECs list of approved batteries go to cleanenergycouncil.org.au/industry/products/batteries/approved-batteries

Batteries on the CEC approved list are required to meet the following requirements:

- Products are independently certified by an accredited certification agency to the safety standards and requirements as specified in the Battery BPG.
- Manufacturer's documentation including datasheets, installation and operating instructions, safety datasheets, warranty terms and conditions meet industry best practice requirements.
- Manufacturer's documentation is accessible to the public on manufacturer and Australian importer websites.

The following is a detailed summary of each battery category:

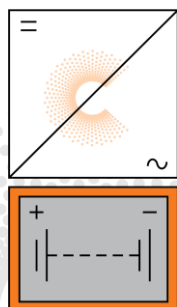
Section 4 BESS



All products that store energy and convert the electricity into AC power are technically BESSs. However, section 4 – BESS:

- Have lithium chemistries
- Are pre-assembled and integrated during the manufacturing process
- Supplied in a dedicated enclosure
- AC output
- Are independently tested to confirm the manufacturer conforms to the requirements of the Battery BPG.
- **Appear on CEC Approved Battery list as a BESS in the equipment category**

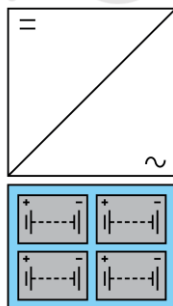
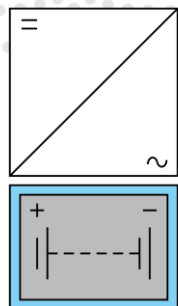
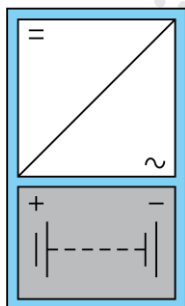
Section 5 BS



Section 5 – BS:

- Have lithium chemistries
- Do not include the power conditioning equipment.
- Supplied in a dedicated enclosure
- DC output
- Are independently tested to confirm the manufacturer conforms to the requirements of the Battery BPG.
- **Appear on CEC Approved Battery list as a BS in the equipment category**

Section 6 Other Batteries



Section 6 – other batteries:

- Any other battery that **does not** appear on CEC Approved Battery list

2.3 Understanding the sections of AS/NZS 5139

Not all sections and/or subsections in AS/NZS 5139 are relevant to all battery installations. CEC accredited persons should go to the CEC Approved Batteries list to ascertain whether they are installing an AS/NZS 5139 section 4 – BESS, section 5 – BS or section 6 – other batteries. Then they should follow the relevant sections outlined in **figure 2.3.1**.

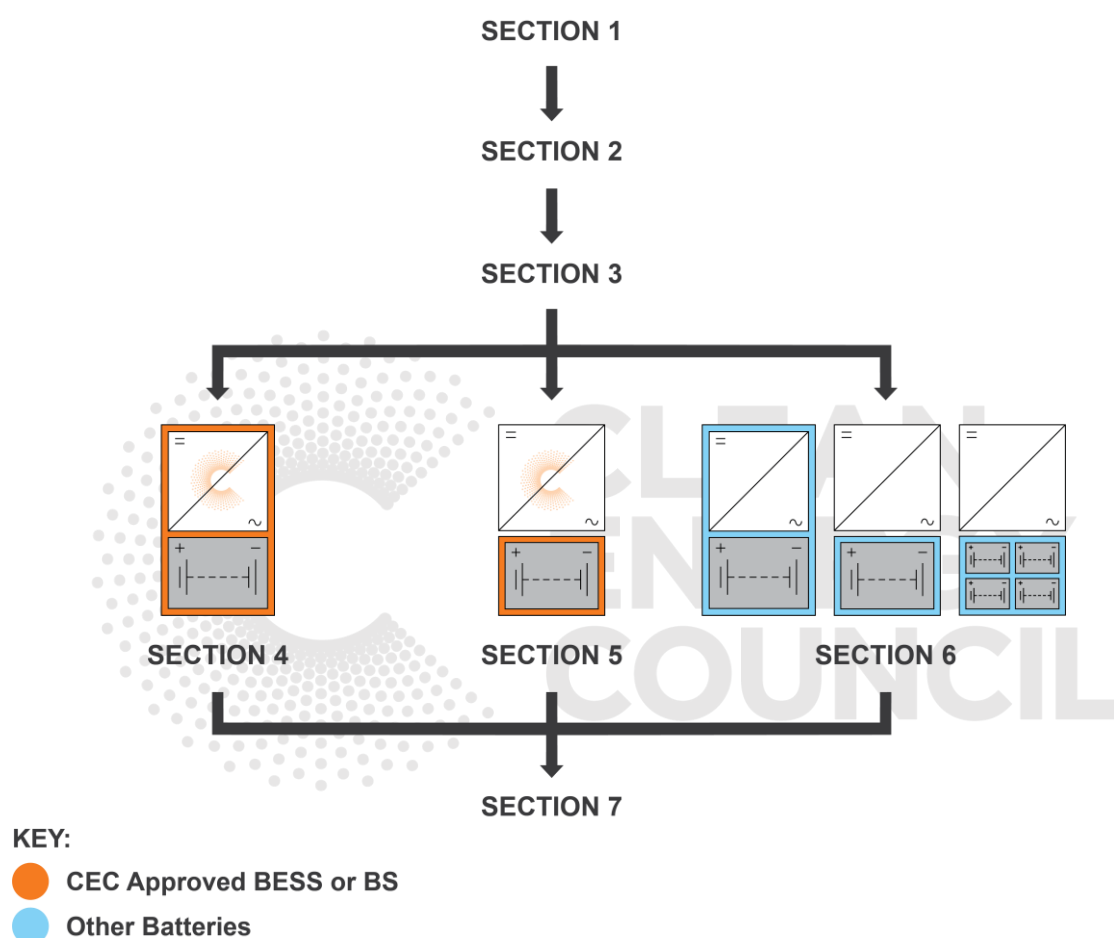


Figure 2.3.1 – breakdown of sections with AS/NZS 5139

3 BATTERY ENERGY STORAGE SYSTEM HAZARDS

3.1 Risk assessment information

AS/NZS 5139 has mandatory requirements to identify all hazards associated with batteries and requires the completion of a risk assessment prior to planning a battery installation.

Many accredited installers have experience with the risk assessment process through safe work method statements (SWMS) or job safety analysis (JSA). SWMS or JSAs are about the safety method you choose to use throughout your installation. However, the risk assessment required by AS/NZS 5139 requires considering more than the installation process or work method.

The risk assessment required by AS/NZS 5139 can be thought of as having two components:

- 1 | Safe work method component
- 2 | Site specific battery system component

This document does not include advice on how to complete the safe work method component. It only considers the site-specific battery system component as required to comply with AS/NZS 5139.

A list of workplace health and safety regulators is available in appendix D.

3.1.1 Risk assessment process

AS/NZS 5139 requires the performance of a risk assessment prior to planning the installation of a battery system, regardless of the type of battery system you plan install. This can be found in clause 4.2.1, 5.2.1 or 6.2.1 depending on the category of battery you are installing.

There are four important steps in a risk assessment as defined in AS/NZS 5139 clause 1.3.36. A risk assessment is an overall process comprising a systematic use of available information to:

- 1 | classify and identify hazards,
- 2 | estimate the inherent risk (risk analysis),
- 3 | determine what control measures may reduce the residual risk, and how
- 4 | evaluate controls to determine whether the residual risk is low enough to install the battery (risk evaluation).

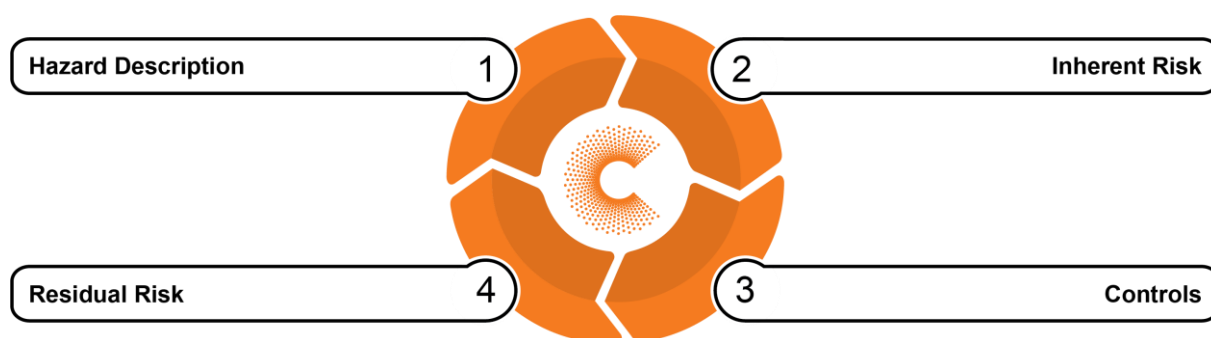


Figure 3.1.1 - risk assessment process

More information on the process of completing a risk assessment can be found in appendix B of this document or in AS/NZS 5139 appendix G.

3.1.2 Risk assessment – site specific battery component

When an accredited person chooses to install a BESS as per the CEC Approved Battery list, AS/NZS 5139 section 3 should be read in conjunction with AS/NZS 5139 section 4.

If an accredited person chooses to install a BS as per the CEC Approved Battery list, AS/NZS 5139 section 3 should be read in conjunction with AS/NZS 5139 section 5.

AS/NZS 5139 section 6 will not be covered in this advice. Accredited persons should refer to the standard for detailed requirements.

Figure 3.1.2 shows how these sections of the standard relate to the completion of the risk assessment process.

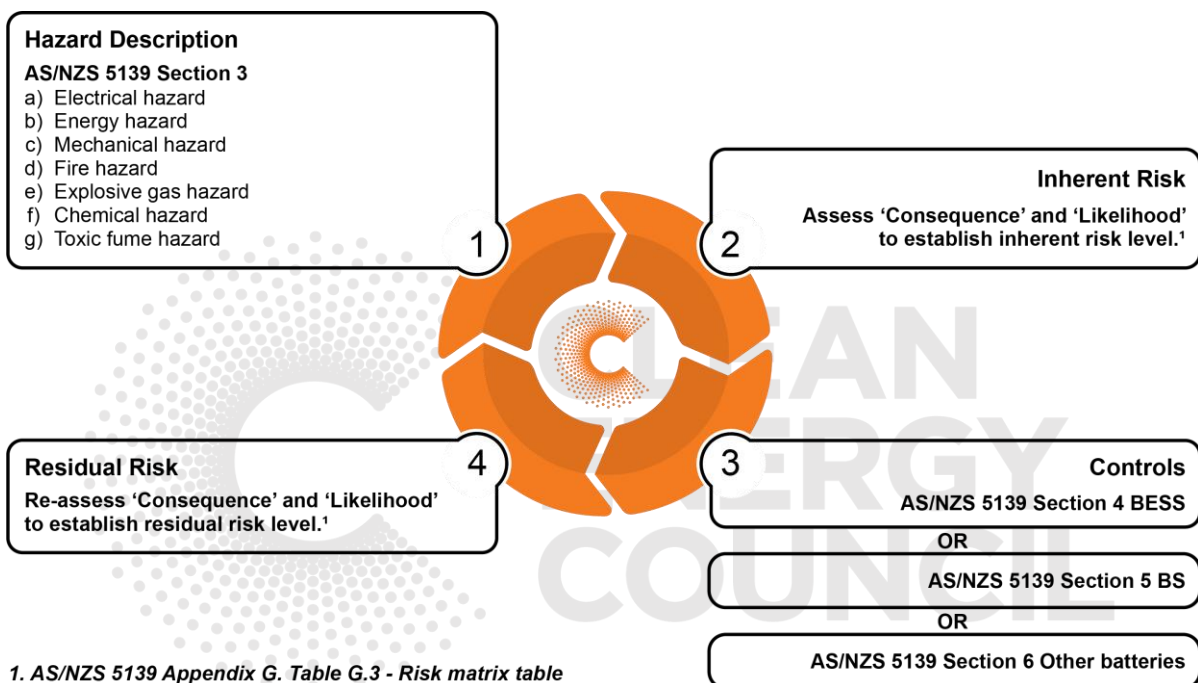


Figure 3.1.2 – AS/NZS 5139 and the risk assessment process

4 INSTALLATION REQUIREMENTS – SECTION 4 – BESS

4.1 Explanation of a section 4 risk assessment

Accredited persons shall carry out a risk assessment for each installation and include any other hazards identified and comply with AS/NZS 3000 and other relevant Australian standards.

A sample risk assessment form is provided in appendix B.

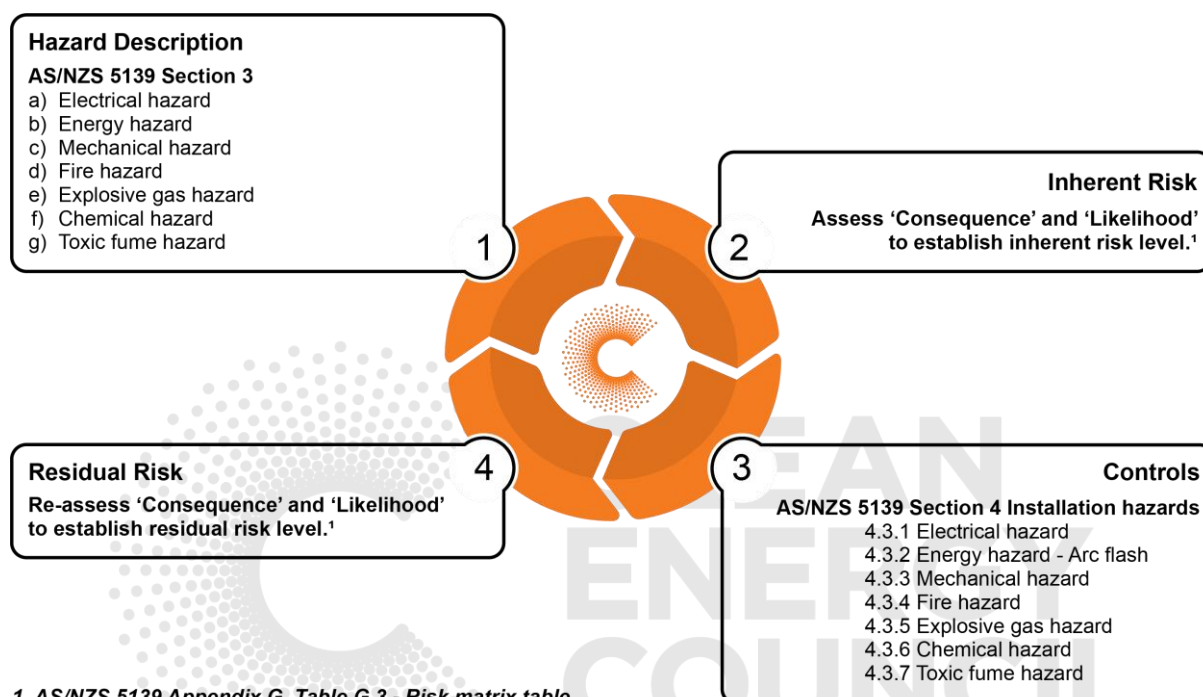


Figure 4.1.1 – risk assessment per section 4 of AS/NZS 5139

4.2 Location

AS/NZS 5139 sets out requirements for the safe installation of battery energy storage systems. The CEC has drafted detailed diagrams to help accredited persons interpret these requirements, refer to appendix A.

4.2.1 Habitable rooms

The definition of a habitable room is provided in AS/NZS 5139 clause 1.3.42. The diagrams in appendix A also highlight some examples.

4.2.2 Restricted locations

Clause 4.2.2.2 outlines locations where a pre-assembled integrated BESS (section 4 – BESS) **can not** be installed.

These restricted locations include:

- a. as for switchboards (AS/NZS 3000)
- b. within 600mm of any exit
- c. within 600mm of any vertical side of a window, or any building ventilation, opening into a habitable room
- d. within 600mm of any appliance
- e. within 900mm below b, c and d
- f. in ceiling spaces
- g. in wall cavities
- h. on roofs (except where specifically deemed suitable)
- i. under stairways
- j. under access walkways
- k. in an evacuation route or escape route.

The rule stating that a battery shall not be installed within 600mm of any exit includes any exit to a building envelope and garage doors.

4.2.3 Environmental requirements

Accredited persons shall follow the manufacturer's instructions when installing a pre-assembled integrated BESS (section 4 – BESS). Consideration should be given to:

- a. highest and lowest temperatures
- b. water and humidity
- c. dust and vermin
- d. protection against UV
- e. other appliances
- f. combustible material.

4.2.4 Protection against the spread of fires

AS/NZS 3000:2018 clause 1.5.12 sets out the requirements for installations to protect against the spread of fire.

In addition to this, there are some specific parameters listed in section 4.2.4 of AS/NZS 5139.

The detailed diagrams in appendix A show examples of barrier requirements and restricted zones for installations.

5 INSTALLATION REQUIREMENTS – SECTION 5 – BS

5.1 Explanation of a section 5 risk assessment

Accredited persons shall carry out a risk assessment for each installation and include any other hazards identified and comply with AS/NZS 3000 and other relevant Australian standards.

A sample risk assessment form is provided in appendix B of this document.

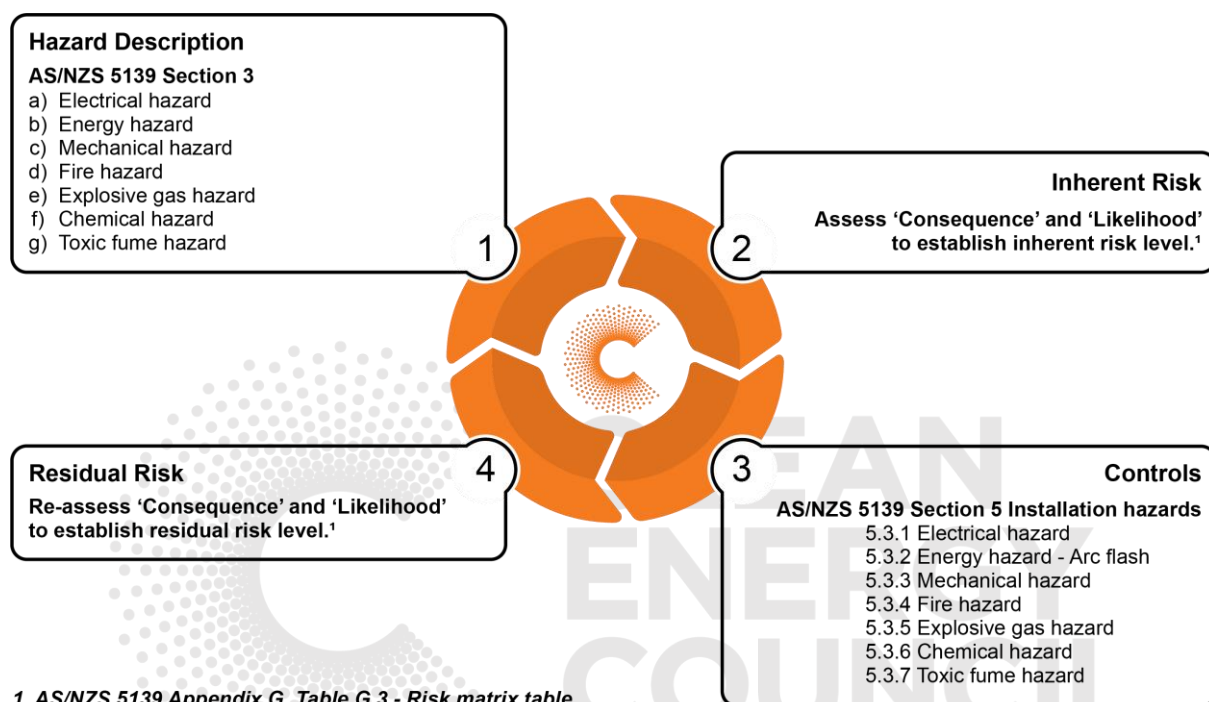


Figure 5.1.2 – risk assessment per section 5 of AS/NZS 5139

5.2 Location

AS/NZS 5139 sets out requirements for the safe installation of battery energy storage systems. The CEC has drafted some detailed diagrams to help installers interpret these requirements. Refer to appendix A for detailed diagrams.

5.2.1 Habitable rooms

The definition of a habitable room is provided in AS/NZS 5139 clause 1.3.42. The diagrams in appendix A also highlight several examples.

5.2.2 Restricted locations

Clause 5.2.2.2 outlines locations where a pre-assembled battery system (section 5 – BS) cannot be installed.

These restricted locations include:

- a. as for switchboards (AS/NZS 3000)
- b. within 600mm of any exit
- c. within 600mm of any vertical side of a window, or any building ventilation, opening into a habitable room
- d. within 600mm of any appliance
- e. within 900mm below b, c and d
- f. in ceiling spaces
- g. in wall cavities
- h. on roofs (except where specifically deemed suitable)
- i. under stairways
- j. under access walkways
- k. in an evacuation route or escape route.

The rule stating that a battery shall not be installed within 600mm of any exit includes any exit to a building envelope, including garage doors.

5.2.3 Environmental requirements

Accredited persons shall follow the manufacturer's instructions when installing a pre-assembled battery system (section 5 – BS). Consideration should be given to:

- a. highest and lowest temperatures
- b. water and humidity
- c. dust and vermin
- d. protection against UV
- e. other appliances
- f. combustible material.

5.2.4 Protection against the spread of fires

AS/NZS 3000:2018 clause 1.5.12 sets out the requirements for installations to protect against the spread of fire.

In addition to this, there are some specific parameters listed in section 5.2.4 of AS/NZS 5139.

The detailed diagrams in appendix A shows several examples including barrier requirements and restricted zones for installations.

6 INSTALLATION REQUIREMENTS – SECTION 6 – OTHER BATTERIES

At this stage, the CEC is not providing advice on AS/NZS 5139 section 6 installations.

The design and installation requirements of section 6 are onerous. These should only be undertaken by experienced, accredited battery system installers.

The CEC will continue to update this document in consultation with the industry.

7 LABELS AND SAFETY SIGNAGE

Section 7 of AS/NZS 5139 details the requirements for labels and safety signage of battery energy storage systems. Additional requirements for signage are also detailed in AS/NZS 4777.1 and AS/NZS 5033, as well as other possible requirements as set out by local electrical safety regulators and/or distribution networks.



APPENDIX A – BATTERY LOCATIONS

Below are some interpretations of possible battery installation locations and their requirements per AS/NZS 5139. See AS/NZS 5139 for more detailed requirements.

The key following should be used to read all diagrams in appendix B.

KEY:

✓	acceptable location	habitable room	non-combustable barrier
✗	unacceptable location	non-habitable room	

Note: The *National Construction Code* (volume 1 and 2) can be used for the classifications of buildings, habitable rooms and some definitions of AS/NZS 5139.

Barrier to habitable rooms – plan 1 – weatherboard house

AS/NZS 5139 clauses 4.2.4.2 and 5.2.4.2

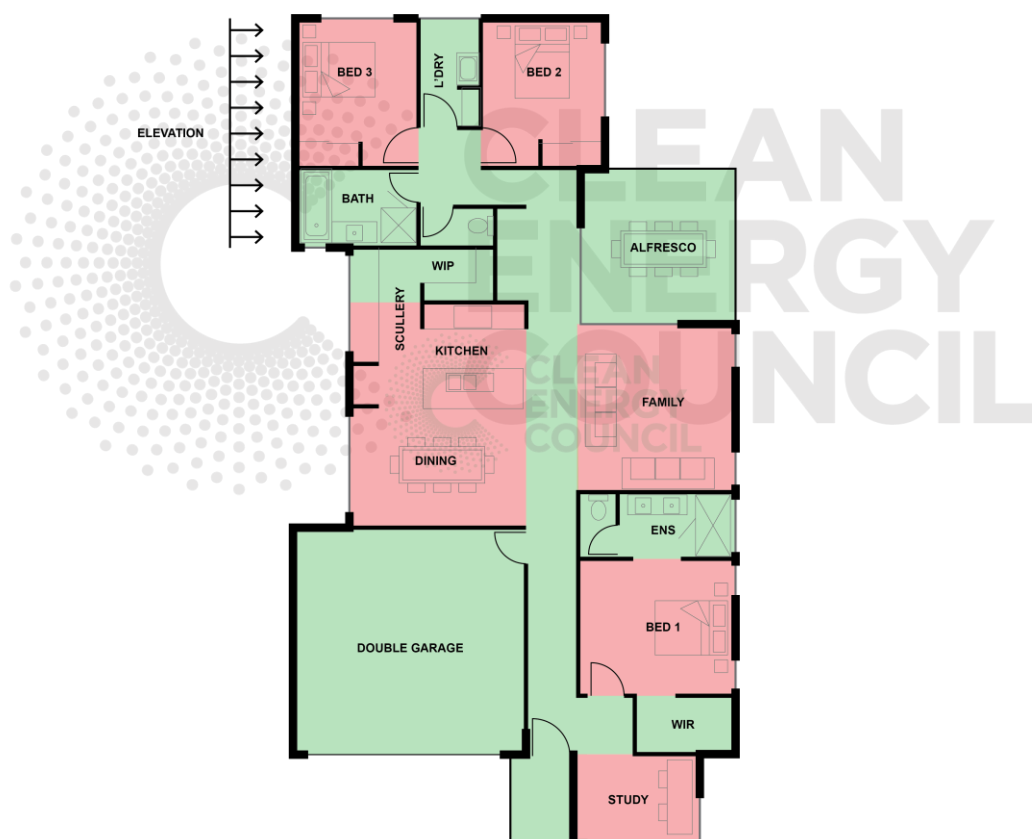


Figure 1a – plan 1 – plan view of a weatherboard house

This image is a reference for elevations shown in figures 1b-e.

The following drawings show a section 4 BESS. The drawings can also be used as a guide to section 5 BS installations. The CEC will continue to update this document based on feedback from CEC-accredited persons.

KEY:



habitable room



non-habitable room



non-combustible barrier

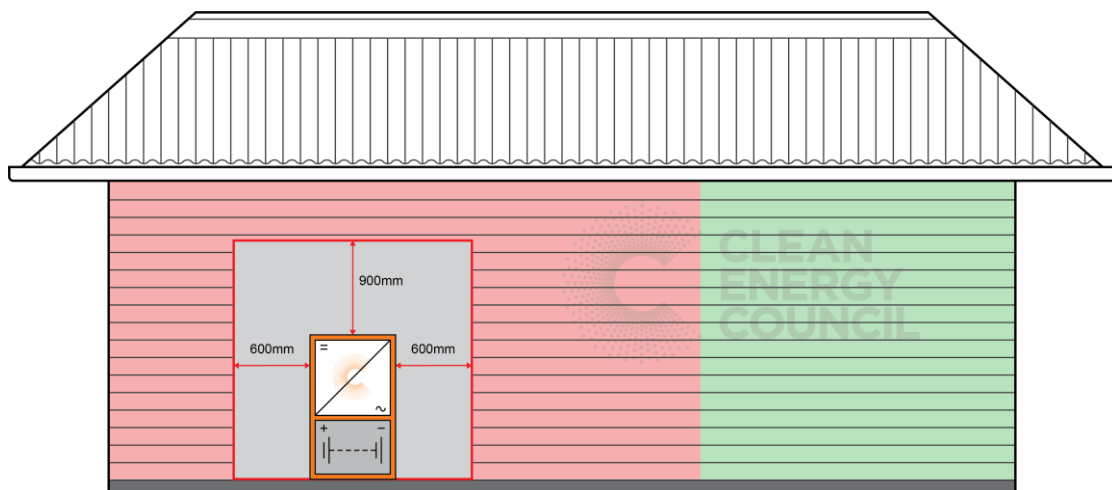


Figure 1b – elevation 1 – on the other side of a habitable room

Battery systems shall have non-combustible material between the battery and the weatherboards.

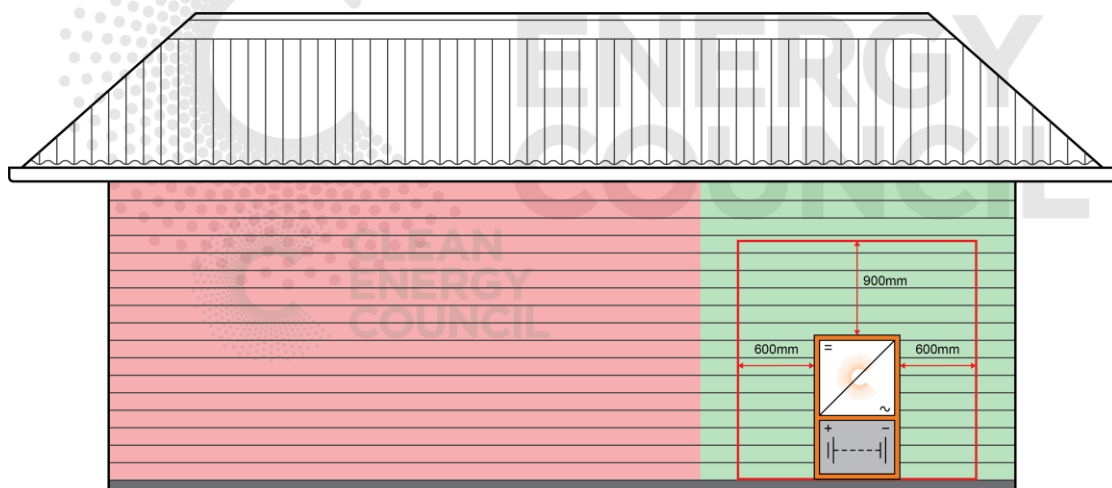


Figure 1c – elevation 1 – on the other side of a non-habitable room

Battery systems do not require non-combustible material between the battery and the surface material when there is a non-habitable room on the other side.

KEY:



habitable room



non-habitable room



non-combustable barrier

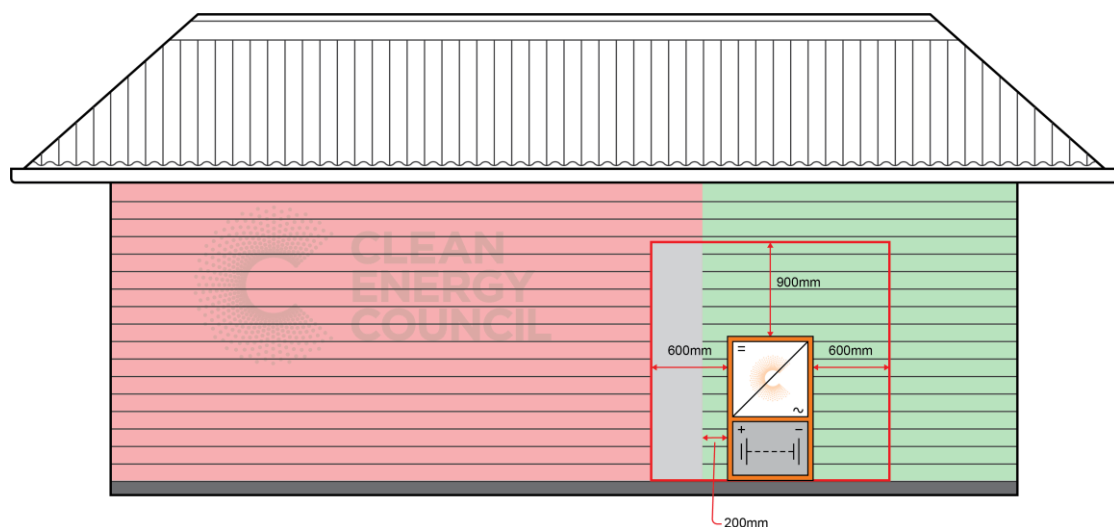


Figure 1d – elevation 1 – near boarder of habitable and non-habitable room

AS/NZS 5139 clause 4.2.4.2 and 5.2.4.2 – apply where the battery system is placed near the surface of a wall with a habitable room on the other side.

Barrier to habitable rooms – plan 2 – weatherboard house

AS/NZS 5139 clause 4.2.4.2 and 5.2.4.2

KEY:

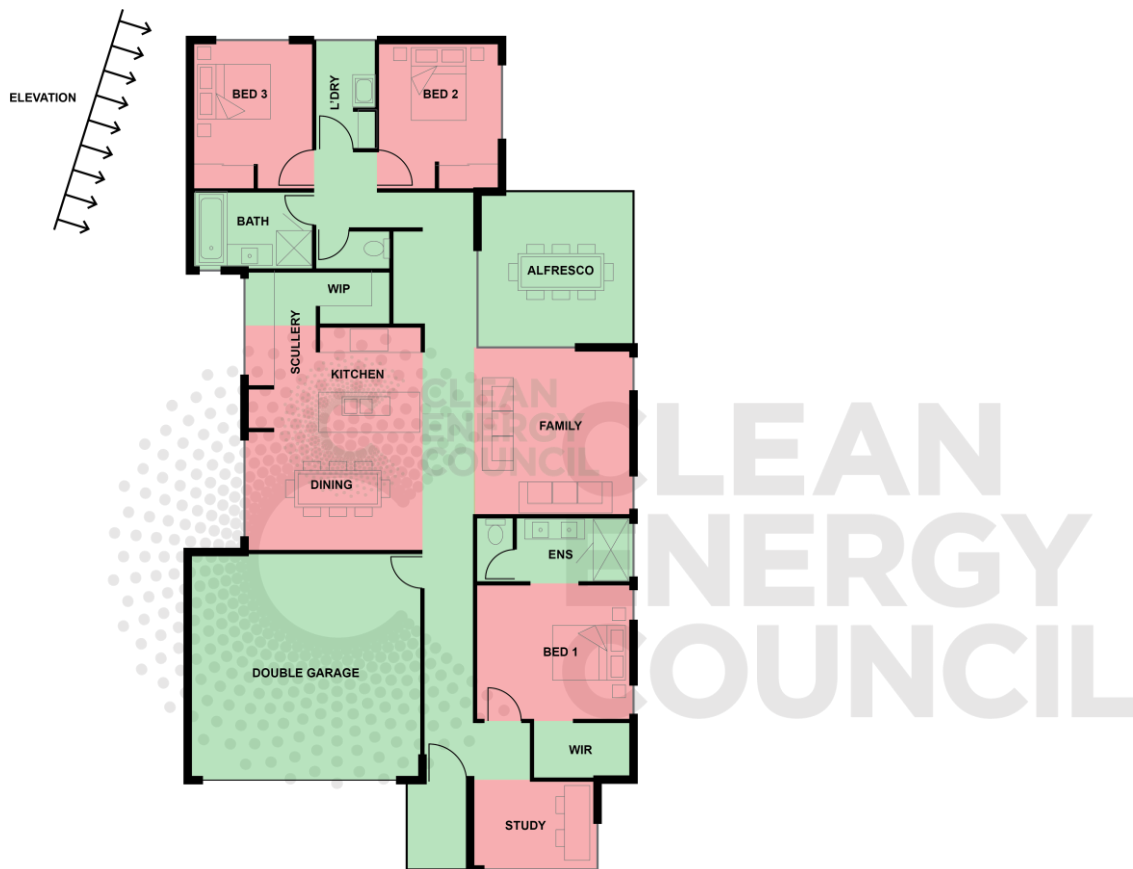


Figure 2a – elevation 2 – plan view of a weatherboard house

This image is a reference for elevations shown in figures 2b-e.

The following drawings show a section 4 BESS. The drawings can also be used as a guide to section 5 BS installations. The CEC will continue to update this document based on feedback from CEC-accredited persons.

KEY:



habitable room



non-habitable room



non-combustable barrier

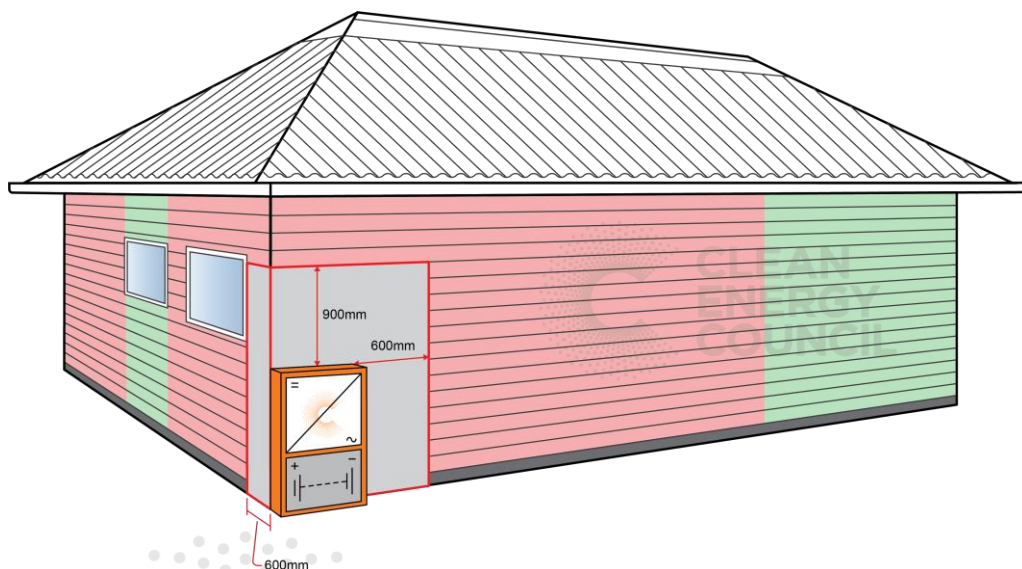


Figure 2b – elevation 2 – flush to the corner of a non-habitable room

AS/NZS 5139 clause 4.2.4.2 and 5.2.4.2 – apply where the battery system is placed near the surface of a wall with a habitable room on the other side.

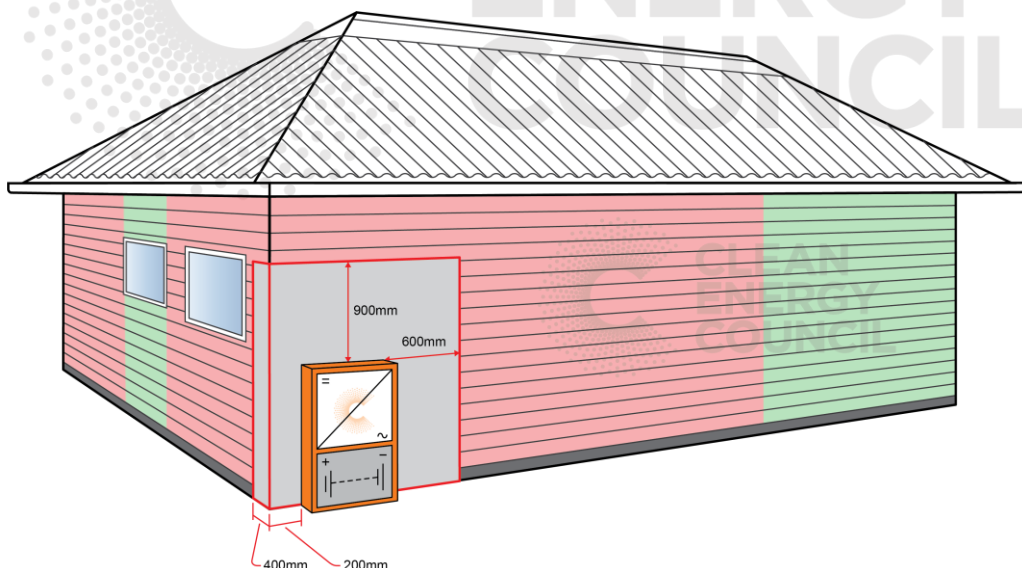


Figure 2c– elevation 2 – 200mm from the corner of a non-habitable room

AS/NZS 5139 clause 4.2.4.2 and 5.2.4.2 – apply where the battery system is placed near the surface of a wall with a habitable room on the other side.

KEY:



habitable room



non-habitable room



non-combustable barrier

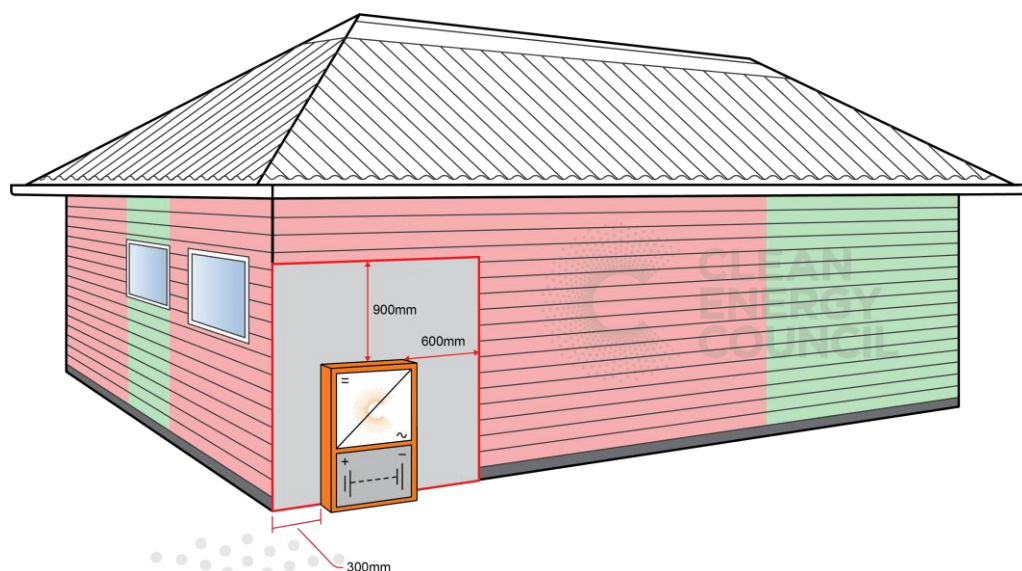


Figure 2d – elevation 2 – 300mm from the corner of a non-habitable room

Where the battery system is 300mm or more from the habitable room, the battery is no longer near the surface of a wall that has a habitable room on the other side.

Restricted locations – brick house

The following drawings show a section 4 BESS. The drawings can also be used as a guide to section 5 BS installations. The CEC will continue to update this document based on feedback from Accredited people.

KEY:

✓	acceptable location	■	habitable room
✗	unacceptable location	■	non-habitable room

AS/NZS 5139 clause 4.2.2.2 and 5.2.2.2 (b) within 600mm of any **exit**.

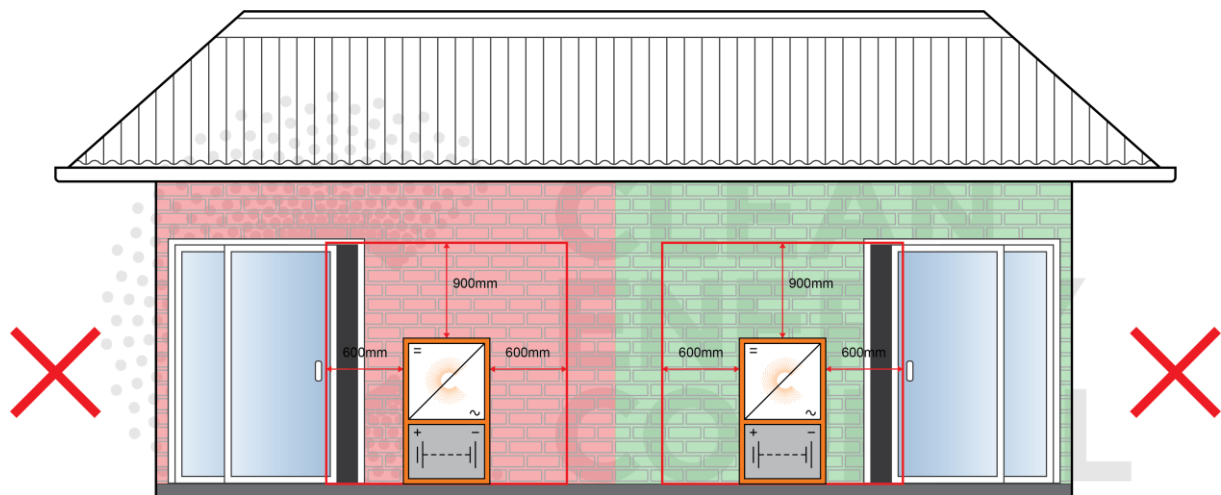


Figure 3a – openable portion of a sliding door less than 600mm to the side

KEY:



acceptable location



unacceptable location



habitable room



non-habitable room

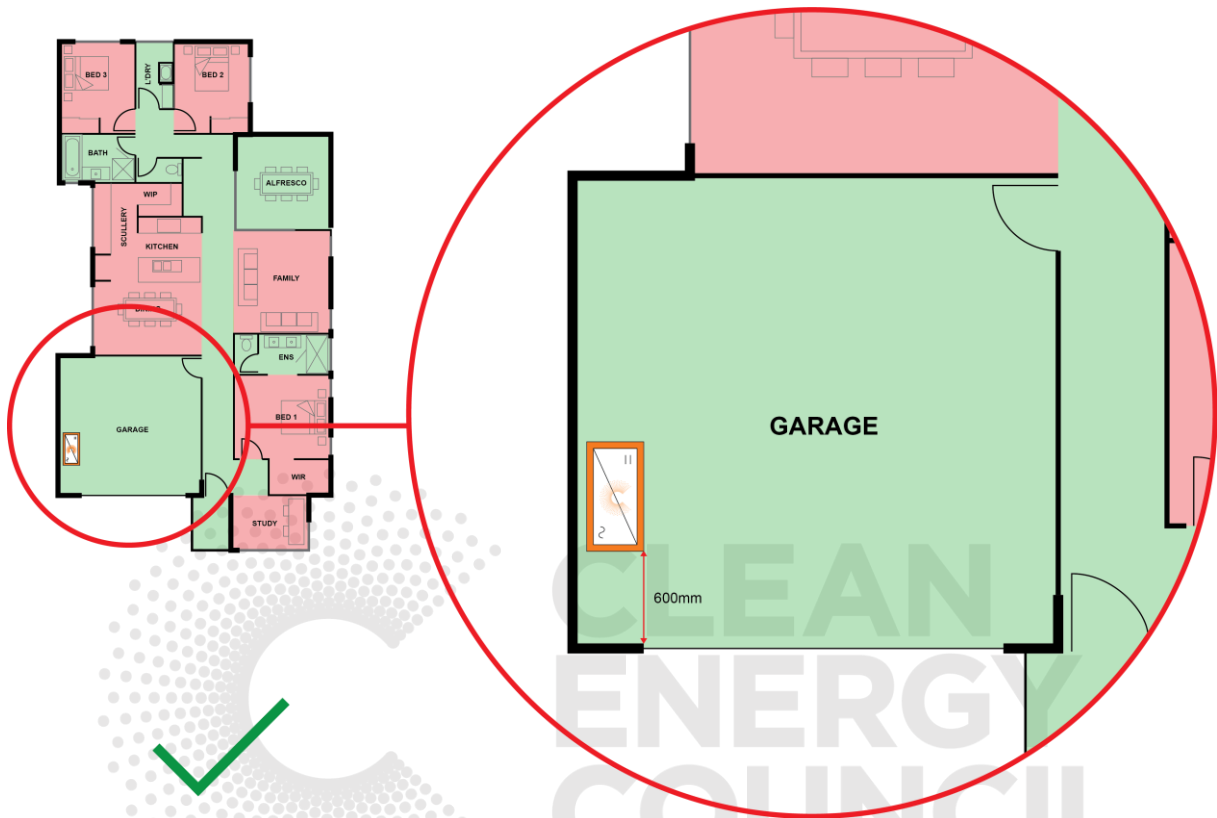


Figure 3b – 600mm clearance from a garage door opening

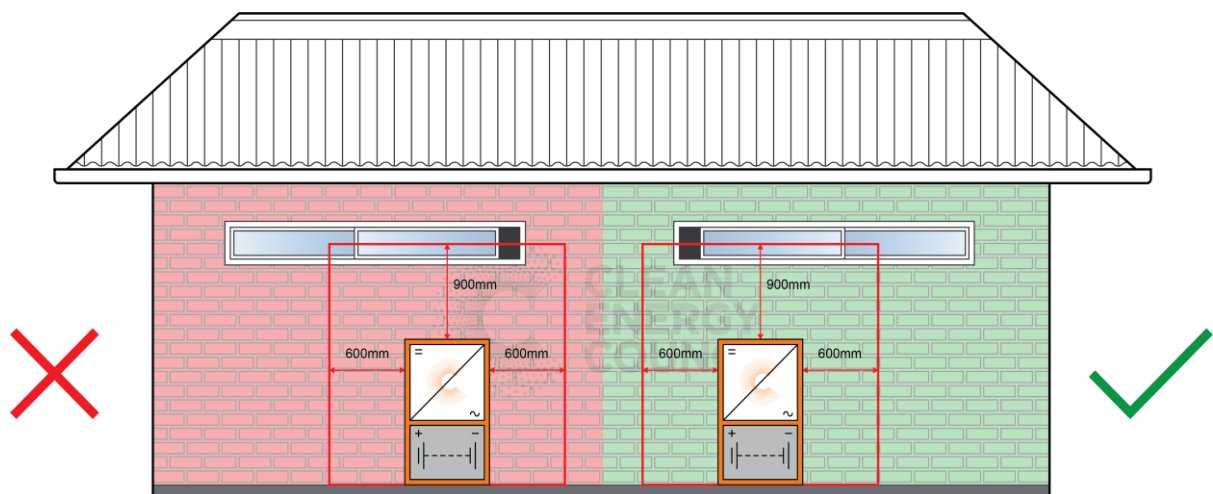


Figure 3d – operable window less than 900mm above

KEY:



acceptable location



unacceptable location



habitable room



non-habitable room

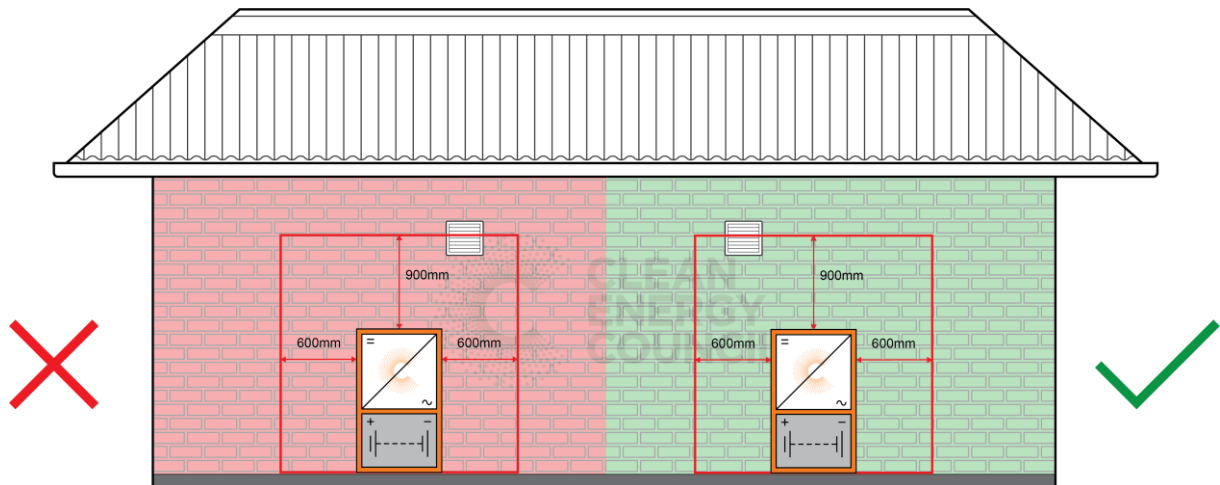


Figure 3e – self closing vent less than 900mm above

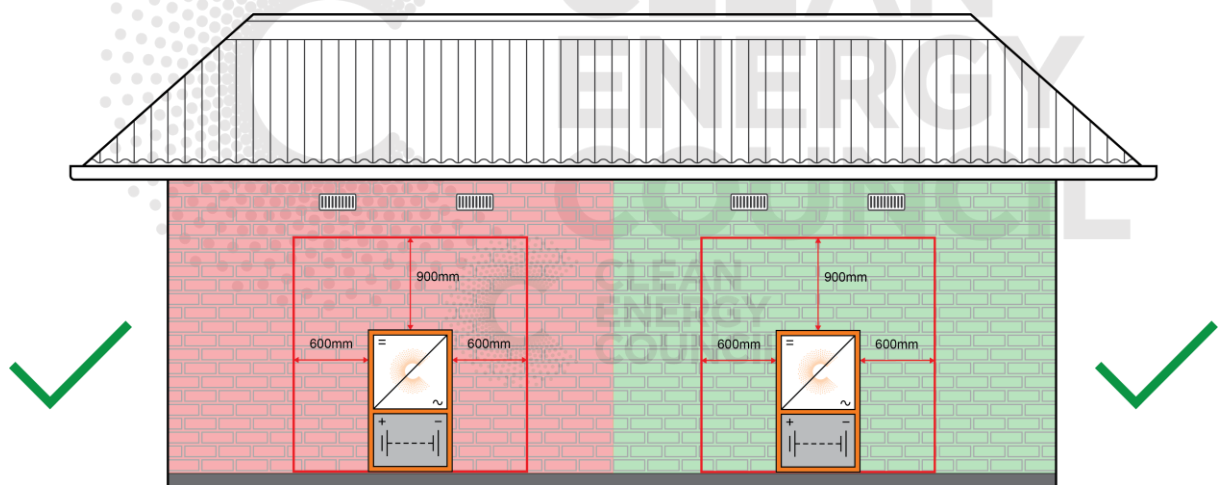


Figure 3f – fixed vent more than 900mm above

APPENDIX B – RISK ASSESSMENT

How to use the sample risk assessment for a CEC approved battery

Address of installation:	
Battery system manufacturer and model:	
DVC level:	
IP rating:	
Battery product type as per AS/NZS 5139:2019	☐ Section 4 – BESS ☐ Section 5 – BS
Assessed by:	
Date of assessment:	
Reviewed by:	
Date of review:	

No.	Hazard description <i>STEP 1</i>	Potential source	Potential consequences	Inherent risk <i>STEP 2</i>	Controls <i>STEP 3</i>	Residual risk <i>STEP 4</i>

The risk assessment required by AS/NZS 5139:2019 has two components:

1. safe work method component and
2. a site-specific battery system component

This sample risk assessment intends to provide installers of battery systems with a guide to carrying out a risk assessment for compliance with AS/NZS 5139:2019. The sample is not a complete risk assessment and does not include on-site Safe Work Method Statements (SWMS) or Job Safety Analysis (JSA).

Installers must carry out a risk assessment for each installation and include any other hazards identified and comply with AS/NZS 3000 and other relevant Australian Standards.

Hazard identification, risk assessment and risk control and evaluation process

The principles of hazard management are **hazard identification, risk assessment and application of appropriate risk control measures** to eliminate the hazard or if this is not practical, to minimise the risks as far as is practical. AS/NZS 5139, appendix G guides this process.

1. Step 1 – hazard description

Hazard identification is the process of identifying all situations or events that could give rise to injury or illness.

AS/NZS 5139, section 3 outlines typical hazard classifications of batteries as displayed in Figure 1 in this document.

The use of a section 5 - BS or section 4 - BESS ensures that the risk of injury from the BS or BESS equipment is minimised as far as is practical. Site-specific hazards must be identified for each installation.

Once each hazard has been identified, they should be documented in the hazard description column of the risk assessment.

2. Step 2 – inherent risk

Risk assessment is the process of determining whether there are any risks associated with the hazards identified and the level of risks involved. This means assessing:

- consequence or severity of the injury or illness if the hazard occurs
- likelihood of it occurring

AS/NZS 5139:2019 appendix G table 3 - risk matrix, may be used for the purpose of risk assessment.

When determining the level of severity or consequence, consider the amount of energy or damage it could cause as if there are no controls in place.

When determining the likelihood of a hazard occurring, the assessment considers the adequacy of current risk controls in place for existing section 5 – BS or section 4 – BESS.

The inherent risk is the risk assessment before any control measure have been employed. Once the inherent risks for each hazard descriptions have been identified, they should be documented in the inherent risk column of the risk assessment.

3. Step 3 – control

A control is a thing, work process or system of work that eliminates an OHS hazard or risk or, if this is not reasonably practicable, reduces the risk so far as reasonably practicable.

AS/NZS 5139 appendix - figure G.1 - control measures and effectiveness, shows the “hierarchy of risk control” methods (involving elimination, substitution, engineering, administration and personal protective equipment). This must be taken into consideration together with “reasonably practicable” considerations when implementing risk controls.

AS/NZS 5139, section 4 outlines controls for the typical hazard classifications of batteries as displayed in figure 1.

Once the controls have been identified, they should be documented in the control column of the risk assessment.

4. Step 4 – residual risk

The residual risk is the risk assessment after the control measures have been employed. The risk assessment methodology outlined in step 2 should be used in this process.

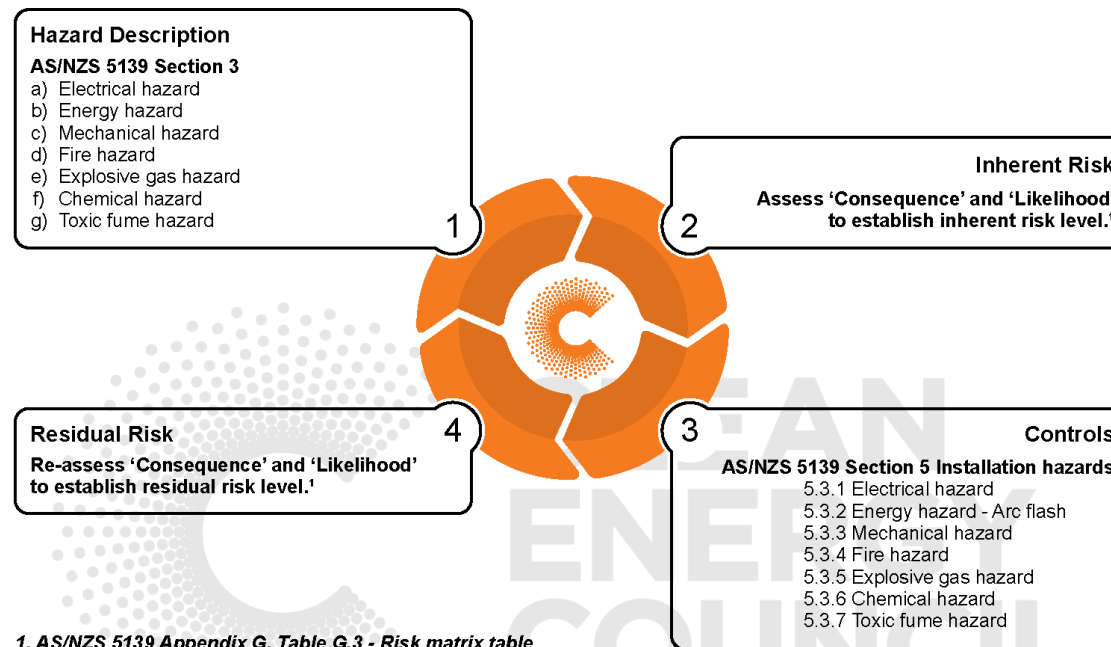


Figure 1: Risk assessment wheel

Blank template – risk assessment for a CEC approved battery

Address of installation:	
Battery system manufacturer and model:	
DVC level:	
IP rating:	
Battery product type as per AS/NZS 5139:2019	☐ Section 4 – BESS ☐ Section 5 – BS
Assessed by:	
Date of assessment:	
Reviewed by:	
Date of review:	

No.	Hazard description <i>STEP 1</i>	Potential source	Potential consequences	Inherent risk <i>STEP 2</i>	Controls <i>STEP 3</i>	Residual risk <i>STEP 4</i>

No.	Hazard description <i>STEP 1</i>	Potential source	Potential consequences	Inherent risk <i>STEP 2</i>	Controls <i>STEP 3</i>	Residual risk <i>STEP 4</i>

Sample risk assessment for a CEC approved battery

Purpose – this sample risk assessment provides accredited persons with a guide to carrying out a risk assessment for compliance with AS/NZS 5139. This sample is not a complete risk assessment and does not include on-site safe work method statements (SWMS) or job safety analysis (JSA).

Accredited persons must carry out a risk assessment for each installation and include any other hazards identified and comply with AS/NZS 3000 and other relevant Australian standards.

This sample risk assessment is based on the selection of a section 5 – BS. For these products, compliance with the Battery BPG has been verified, including fault conditions such as short circuit, overvoltage, overcharge or discharge. Therefore, the risk from the product itself of fire, explosion, discharge of flammable gas, rupture or leakage is expected to be minimized.

Address of installation:	
Battery system manufacturer and model:	
DVC level:	
IP rating:	
Battery product type as per AS/NZS 5139:2019	☐ Section 4 – BESS ☒ Section 5 – BS
Assessed by:	
Date of assessment:	
Reviewed by:	
Date of review:	

No.	Hazard description <i>STEP 1</i>	Potential source	Potential consequences	Inherent risk <i>STEP 2</i>	Controls <i>STEP 3</i>	Residual risk <i>STEP 4</i>
1	Electrical and other hazards	- contact with live conductors - fault or short circuit current from the battery impacting	- electrocution - fire	High	Follow the relevant section of AS/NZS 5139:2019 such as:	Medium

No.	Hazard description <i>STEP 1</i>	Potential source	Potential consequences	Inherent risk <i>STEP 2</i>	Controls <i>STEP 3</i>	Residual risk <i>STEP 4</i>
		the rest of the electrical installation	battery overheating or a rupture leading to hazards identified below		- Section 3 provides the types of hazards associated with battery energy storage systems. - Section 5 provides the installation requirements for section 5 – BS.	
2	Energy hazards ¹	- arc flash from insufficient isolation or insulation - some parts of a BS may remain energised. - INCIDENT ENERGY CALCULATION cal/cm2 <i>NOTE: See Table G5 of AS/NZS 5139:2019 Clause 3.2.4.2.1 to determine arc flash incident energy.</i>	burns to eyes and skin	High	- installation and maintenance activities shall be done as per the manufacturer's instructions - inspect equipment for damage before installing. - remove exposed metal or conductive items such as jewellery, zips, watches - arc flash boundary - PPE level..... - use PPE level..... when working within cm of live parts	Medium
3	Mechanical hazards	- crush by weight of batteries or equipment - crushing by falling over/tipping of batteries	- crushing to body parts - site-specific consequences³:	Medium	installation and maintenance activities shall be done as per the manufacturer's instructions	Low

¹ This hazard should be considered for all section 5 BSs, and additionally for all section 4 – BESSs where the installer is required to make connections on the DC side of the system (e.g. connecting equipment that is delivered to site as two or more modules). should be considered for each individual situation.

³ Site specific sources of consequences (e.g. damage to battery system, creating toxic fume or other hazards) should be considered for each individual situation.

No.	Hazard description STEP 1	Potential source	Potential consequences	Inherent risk STEP 2	Controls STEP 3	Residual risk STEP 4
		- BATTERY WEIGHTkg - site-specific hazards²:			- adequate structural strength of supporting provided - site-specific controls⁴:	
4	Fire, chemicals and biological hazards <i>NOTE: NA in relation to the hazard classification Table 3.1 of AS/NZS 5139:2019⁵</i>	- excessively high or low temperatures - over and under-voltage - overcharged or over-discharged - puncturing or failure of the battery casing - thermal runaway - internal short circuit	burns to eyes and skin	Medium	Section 5 – BS are not expected to create fire, chemicals and biological hazards. See Table 3.1 of AS/NZS 5139	Low
5	Explosive gas hazards	- explosive gas generated by batteries - inadvertent ignition of flammable gas.	- burns to eyes and skin - secondary injuries as a result of explosions	 ⁶	- follow manufacturers advice on Installation and maintenance activities - inspect equipment for damage before installing	 ⁶
6	Toxic fumes hazards	Consult manufacturer for advice on Toxic fumes generated from different types of batteries in:	Consult manufacturer for advice on:	 ⁶	follow manufacturers advice on installation and maintenance activities	 ⁶

² Site specific sources of hazards (e.g. impact from vehicles), should be considered for each individual situation. should be considered for each individual situation.

⁴ Site specific sources of controls (e.g. bollards) should be considered for each individual situation.

⁵ Material Safety Data Sheets shall be provided at the completion of installation. (Refer to AS/NZS 5139:2019 Clause 6.4.1)

⁶ The risk level for this hazard will depend on the battery chemistry. This can vary across various CEC approved batteries, so the CEC is unable to provide this inherent risk in the template. Accredited persons will be required to consult the manufacturer and assess site considerations to determine the inherent risk rating and the residual risk.

No.	Hazard description <i>STEP 1</i>	Potential source	Potential consequences	Inherent risk <i>STEP 2</i>	Controls <i>STEP 3</i>	Residual risk <i>STEP 4</i>
		- normal operation - fault conditions	- poisoning - asphyxiation - burns to airway tissues (e.g. from corrosive gases) - other consequences		- inspect equipment for damage before installing. - Section 5 – BS are not expected to create toxic fumes hazards. <i>See Table 3.1 of AS/NZS 5139</i>	

Risk assessment form columns

Hazard description – as described in AS/NZS 5139:2019.

Potential source – any or *reasonably foreseeable abnormal conditions or reasonably foreseeable misuse*

Potential consequences – the most likely outcome

Inherent risk – cross-referencing the consequence against the likelihood of it occurring in the risk matrix (before the controls are implemented)

Controls – should consider the hierarchy of control methods described in the relevant OHS/WHS regulations and AS/NZS 5139:2019

Residual risk – cross-referencing the consequence against the likelihood of it occurring in the risk matrix (after the controls are implemented)

Risk assessment

The focus of this risk assessment is on the risk control measures necessary to minimise risks from exposure to the hazards associated with the installation, operation and maintenance of the battery systems.

AS/NZS 5139:2019, Appendix G provides guidance in the hazard identification, risk assessment and risk control and evaluation process.

The principles of hazard management **are hazard identification, risk assessment and application of appropriate risk control measures** to eliminate the hazard or if this is not reasonably practicable, to minimise the risks as far as is reasonably practicable.

1.1 Hazard Identification

Hazard identification is the process of identifying all situations or events that could give rise to the potential of injury or illness. The use of a section 5 – BS ensures that the risk of injury from the battery system equipment is minimised as far as is reasonably practicable. Site-specific hazards must be identified for each installation.

1.2 Risk assessment

Risk assessment is the process of determining whether there are any risks associated with the hazards identified and the level of risks involved. This generally involves:

- Consequence or Severity of the injury or illness if the hazard occurs
- Likelihood of it occurring

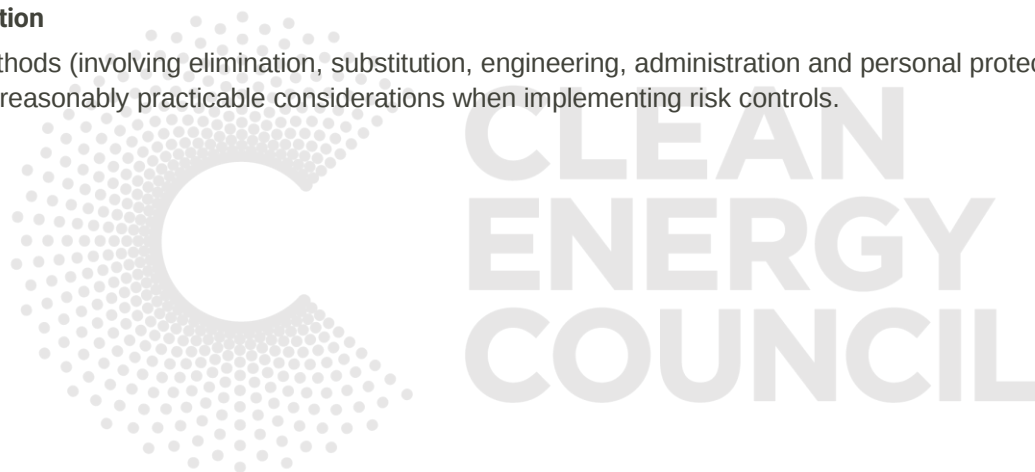
AS/NZS 5139:2019, appendix G, table 3 - risk matrix, may be used for risk assessment.

When determining the level of severity or consequence, consider the amount of energy or damage it can cause as if there are no controls in place.

When determining the likelihood of a hazard occurring, the assessment considers the adequacy of current risk controls in place for existing battery systems.

1.3 Risk control and evaluation

The hierarchy of risk control methods (involving elimination, substitution, engineering, administration and personal protective equipment) must be taken into consideration together with reasonably practicable considerations when implementing risk controls.



APPENDIX D – WORK HEALTH AND SAFETY

The CEC is not a safety regulator and cannot advise on high-risk work such as:

- working at heights where a person has a risk of falling more than 2 metres
- on or near energised electrical installations or services.

Across Australia each state and territory have different definitions and requirements for their obligations towards work health and safety (WH&S). If you need help, please contact your state or territory work health and safety authority:

