Technical guidance sheet 2.1

Physical protection of battery systems

Solar Victoria

VICTORIA State Government

This guidance provides further information to support installers' understanding of applicable requirements in AS/NZS 5139:2019 *Electrical installations – Safety of battery systems for use with power conversion equipment*.

To help installers maintain standards, it includes installation advice and examples of installations that may not be meeting the requirements relating to the physical protection of battery systems.

This guidance is part of a series Solar Victoria commissioned TechSafe Australia to develop. Energy Safe Victoria has also reviewed this guidance.

In series 2:

Disclaimer

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

The information provided within has been put together to highlight specific aspects of several Australian installation standards that include, but not limited to AS/NZS 3000:2018 *Electrical installations (known as the Australian/New Zealand Wiring Rules)*, AS/NZS 5033:2021 *Electrical installations - Safety of battery systems for use with power conversion equipment*, AS/NZS 4777.1:2016 *Grid connection of energy systems via inverters, Part 1: Installation requirements*. While care has been taken to provide examples that highlight specific defects or compliance it should not be assumed that additional defects are not present in the supplied examples. It is a requirement that all aspects of the relevant Australian installation standards are followed, and compliance of any installation remains the responsibility of the installer.

This document is designed around providing best practice solutions for specific scenarios. Any advice given is general in nature and if possible, solutions to compliance issues are highlighted, it should not be assumed these are the only methods to achieving compliance.

Content provided in this guidance document has been extracted from multiple sources that are referenced on the same page. This content has been collated to help provide an overview and in no way should be referenced on its own. It is intended that all referenced material is also read in conjunction with the rest of its relative material to ensure full understanding of the context, relationship with other parts and anything not mentioned in this overview.

Mechanical protection of battery systems:

Adequate mechanical protection for locations that a vehicle may access

When assessing a location to install a battery system, it is important to take note of likely causes of mechanical damage that could occur to the battery system now and for the expected lifetime of the system.

Non-fixed/movable benches and cupboards may not provide suitable protection, as the homeowner could decide to move them in the future.

Additionally, if the area in question could allow a vehicle to enter the space (regardless of the homeowner's non-fixed objects) suitable fixed vehicle mechanical protection must be installed.

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1 & 5.2.2.1

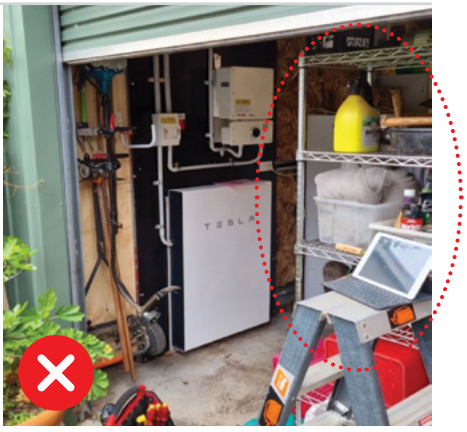


Figure 1.1:
Non-fixed shelving is not adequate mechanical protection for a battery system installed in an area accessible to cars.

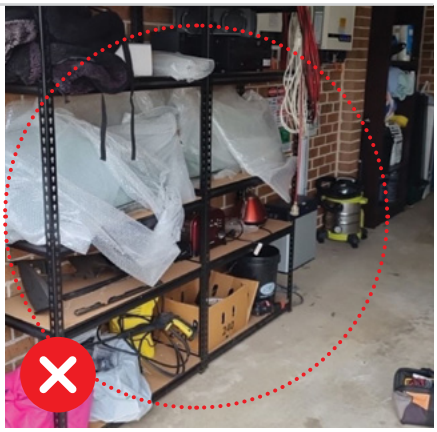


Figure 1.2:
Racking systems such as these can be moved, making them inadequate as mechanical protection for batteries.

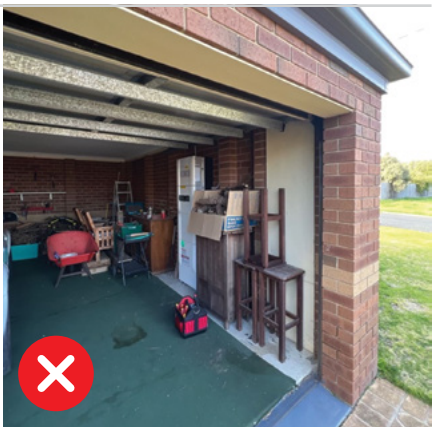


Figure 1.3:
A vehicle could enter into this space, meaning that fixed vehicle mechanical protection would be required regardless of any non-fixed objects that could be installed.

Mechanical protection of battery systems:

Garage pillars/walls may not provide suitable mechanical protection on their own

Where the battery system is located in the front corner of a typical 6m long garage and is protected by a solid front pillar or wall, it is reasonable to expect vehicle impact could not occur. A bollard therefore may not be required in this location (see Fig 2.1).

Note: As a guide, the protected area is calculated at a ratio 1:2.5 i.e. a 500 mm garage pillar would allow an area of 1250mm protection along the wall.

If the battery system is set further back than the area afforded protection by the garage pillar, additional protection may be required.

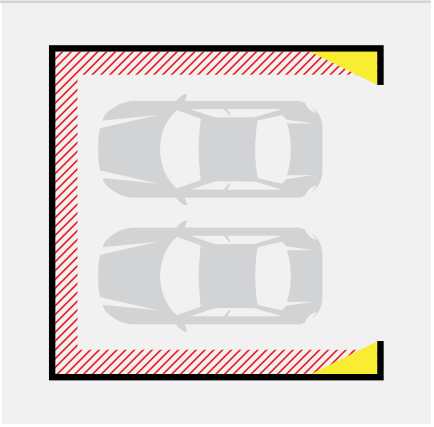
Additionally, if the garage is longer than 6m, and could allow a vehicle to proceed past the battery system, additional mechanical protection may also be required on the trailing edge of the battery system.

Each installation must be assessed for potential hazards and any reduction methods implemented.

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1 & 5.2.2.1

Figure 2.1:
Diagram demonstrating mechanical protection afforded by garage pillar walls for a standard double garage 6m x 6m and standard single garage 4m x 6m.



Area requiring additional mechanical protection (such as a bollard)

Area deemed protected by the garage pillar, not requiring additional protection

Figure 2.2:
The battery is too far away from the front corner of the garage and would require additional mechanical protection to be compliant.

Figure 2.3:
Like Figure 2.2, there is not adequate protection provided by the front corner of the garage without the installation of additional protection.

Mechanical protection of battery systems:

Additional protection may be required on trailing edges of battery systems

In this example, the installed battery system was initially considered to have sufficient mechanical protection for vehicle strike from the leading edge.

However, after further inspection it was determined that a vehicle could travel past the battery system and potentially strike the battery system from the trailing edge (i.e. edge located furthest from the mechanical protection).

As such, an additional bollard would need to be installed near the trailing edge of the battery system observed in this example to ensure adequate mechanical protection from vehicle strike.

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1 & 5.2.2.1

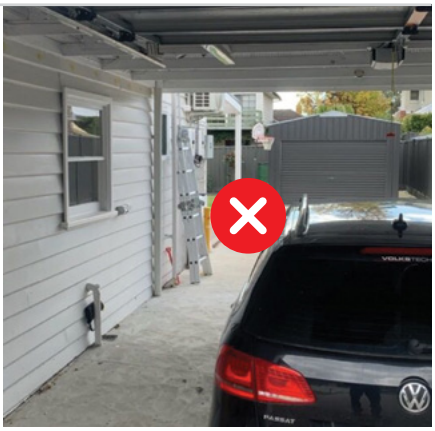


Figure 3.1:
Adequate protection has been provided on the front edge, but the driveway extends well past this point.

Figure 3.2:
As noted in Figure 3.1, there is adequate area for a car to drive beyond the edge of the battery, this requires additional mechanical protection be installed on the trailing edge of the battery.

Figure 3.3:
The absence of trailing edge protection in an area accessible by vehicles makes this system non-compliant.

Mechanical protection of battery systems:

One vehicle bollard may not be adequate mechanical protection in all scenarios

In this example, a bollard has been installed in front of the battery system to protect against vehicle strike.

The centre placed bollard is inadequate to protect against potential vehicle strikes on the left and right-hand sides of the battery. Suggested compliant protection for this example may include the installation of two additional bollards (either side of the battery) or a U-shaped bollard system installed around the front of the battery system.

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1 & 5.2.2.1

Figure 4.1:
The following system provides no protection against a car-strike on the left or right side of the battery and is therefore not compliant.

***Figure 4.2**:*
The presence of two cars highlights the possibility of a car strike despite the attempt to provide mechanical protection with the bollard.

Figure 4.3:
The following system provides mechanical protection across the width of the battery, unlike the system shown in Figures 4.1 and 4.2.

Mechanical protection of battery systems:

Height of battery system installation may not provide adequate mechanical protection on its own

In these examples, an attempt has been made to install the battery systems higher than the bonnet of the homeowner's (current) vehicle to try and mitigate potential vehicle strike. This may not provide adequate protection for a range of potential scenarios, such as a larger vehicle (e.g. an SUV) reversing in, or visitors with different car shapes (e.g. vans, utes).

Additionally, there is always the possibility of the current homeowner or future homeowners using the area to store a trailer or boat.

As such, additional bollards may be required to be installed in all three of these examples to provide mechanical protection against vehicle strikes.

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1 & 5.2.2.1

Figure 5.1:
The battery here requires mechanical protection as it would be possible for a van to enter this driveway and subsequently strike the battery.

Figure 5.2:
Despite being above the ground, this battery is clearly within the range of the blue car shown in the image, particularly if reversing into the driveway. As such, further mechanical protection is necessary.

Figure 5.3:
Similar to Figure 5.1, this is not high enough to be out of the range of vans or large cars such as SUVs.

Mechanical protection of battery systems:

Some GOOD examples of battery system mechanical protection

Refer to the corresponding figure on this page when reading each description.

In Figure 6a: Garage pillar wall provides mechanical protection on leading edge, and vehicle bollard provides mechanical protection on the trailing edge of the battery system.

In Figure 6b: There is no garage pillar protection, so the installer has provided mechanical protection on both the leading and trailing edges of battery system to mechanically protect against potential vehicle strikes.

In Figure 6c: Garage pillar is not wide enough to provide sufficient side impact mechanical protection, so additional vehicle bollards have been installed on the leading and trailing edges of the battery system to mechanically protect against potential vehicle strikes.

In Figure 6d: One bollard would not be sufficient to mechanically protect this battery system from the left and right sides. Two vehicle bollards have been installed (one on the left and one on the right), spaced close enough together to prevent a car from fitting between.

Figure 6a

Figure 6b

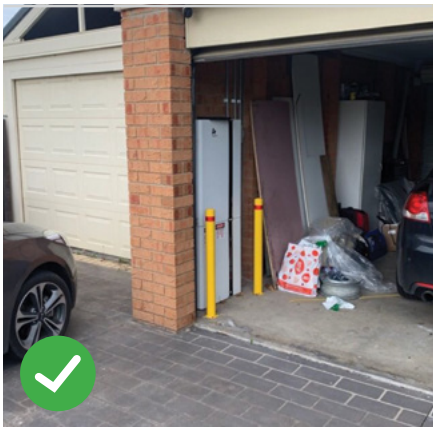


Figure 6c

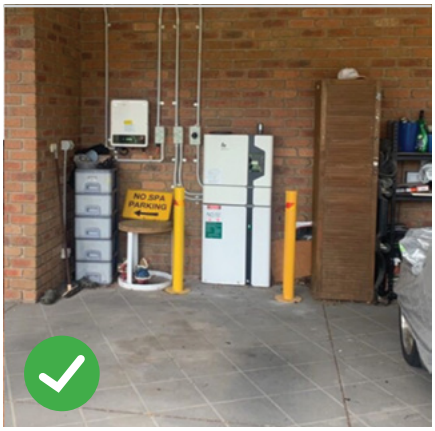


Figure 6d

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1 & 5.2.2.1

Battery protection against the effects of water ingress:

Electrical equipment with IP ratings less than IP33 must be sufficiently protected against water ingress

In these examples, a battery system has been installed with an ingress protection rating of IP30. This means there is no water ingress protection provided by the battery enclosure.

The installer has made an attempt at protecting the battery system by installing a small veranda/overhang above the battery.

As the electrical equipment has no water ingress protection rating, in this example the entire piece of equipment would need to be located within 30 degrees of an adequately waterproofed veranda or overhang (as per AS/NZS 3000:2018 Clause 4.1.3).

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1, 4.2.3.2, 5.2.2.1 & 5.2.3.2

AS/NZS 3000:2018
Clauses 4.1.2 & 4.1.3

Figure 7.1:
The highlighted yellow text (the label on the front of the battery) indicates an ingress protection rating of IP30 – meaning there is no protection against the ingress of water provided by the battery's enclosure.

Figure 7.2:
Due to the IP30 rating, the whole battery is required to be within 30 degrees of a waterproof overhang or veranda. This is not occurring in this image – the veranda is too small.

Figure 7.3:
The large green roof above the battery system is made from shade cloth, which is not waterproof and does not provide appropriate water ingress protection to the battery system.

Protection against the effects moisture and direct sunlight:

Please ensure you follow all manufacturer's additional installation requirements

Most manufacturers will stipulate additional installation requirements above the minimum requirements outlined in Australian installation standards. Please ensure you read these before beginning any works and apply as required under AS/NZS 3000:2019 Clause 4.1.2 (e).

Here are two examples of where batteries have been installed without taking into account manufacturer's requirements for exposure to direct sunlight and moisture.

These are the manufacturer's installation location requirements for the battery systems shown in Figures 8a and 8b. In particular, the 'notice' highlights the requirement to avoid exposing battery to direct sunlight and moisture.

Installation location

Make sure the installation location meets the following conditions:

- The building is designed to withstand earthquakes.
- The location is far away from the sea, to avoid salt water and humidity.
- The floor is flat and level.
- There are no flammable or explosive materials nearby.
- The optimal ambient temperature is between 15°C and 30°C.
- The temperature and humidity stays at a constant level.
- There is minimal dust and dirt in the area.
- There are no corrosive gases present, including ammonia and acid vapour.

NOTICE:
The RESU battery pack is rated at IP55 and thus can be installed outdoors as well as indoors. However, if installed outdoors, do not allow the battery pack to be exposed to direct sunlight and moisture.

Figure 8a:
This system has no protection from direct sunlight or moisture, making this system non-compliant with manufacturer's instructions.

Figure 8b:
Like the system in 8b, no protection from sunlight or moisture has been provided for t his battery system.

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1, 4.2.3.2, 5.2.2.1 & 5.2.3.2

AS/NZS 3000: 2018
Clauses 4.1.2 & 4.1.3

Protection against the effects of vermin:

Battery and cable entries must be appropriately sealed to stop the entry of potential vermin

Most manufacturers will supply additional bungs or sealing kits for unused cable entry points into their battery systems.

It is important these unused cable entry points are correctly sealed to prevent the entry of vermin and also to maintain the manufacturer's Ingress Protection (IP) ratings.

Please also ensure all enclosure cable entries and adaptors are appropriately installed and sealed to prevent the entry of vermin and moisture. This may include utilising rubber bungs, rings, glue and pips etc, as per the manufacturer's instructions.

Standards referenced:

AS/NZS 5139:2019
Clauses 4.2.2.1, 4.2.3.2, 5.2.2.1 & 5.2.3.2

AS/NZS 3000:2018
Clauses 3.3.2.10, 4.1.2 & 4.1.3

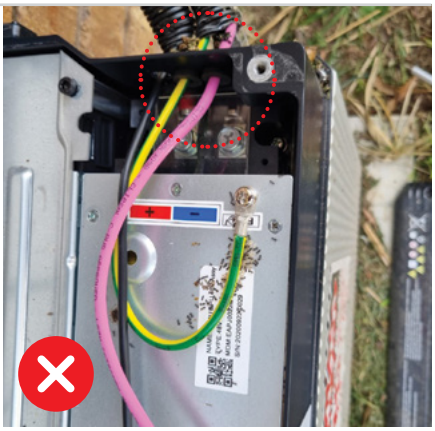


Figure 9a:
In this example the cable entries to the battery system have not been correctly sealed to prevent entry to flora/ fauna resulting in vermin creating a nest.

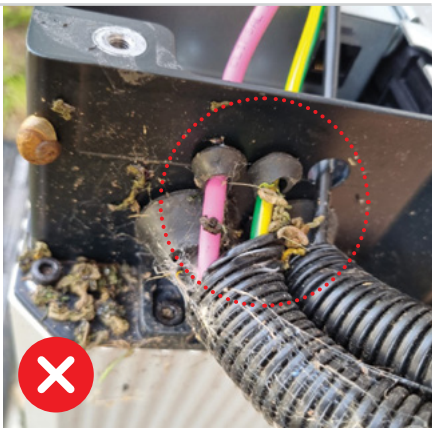


Figure 9b:
As can be seen, the manufacturers cable entry seals have not been correctly installed and thus gaps are evident, which can lead to the entry of flora and fauna.

Figure 9c:
In this example the unused cable entries on the left of the battery system have not been sealed to prevent the ingress of flora and fauna.

More information

For more information about Solar Victoria's commitment to safety and quality, including our audit program, checklists, and training and workforce development visit: solar.vic.gov.au/industry

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