



Member Information Paper

Lithium-ion Batteries

Contact: Margaret Noonan

March 2024

Assistive Technology Suppliers Australia
Suite 302, Level 3 Lawson Place
165 -167 Phillip St Sydney NSW 2000

02 8006 7357
www.atsa.org.au

info@atsa.org.au

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Purpose of this Information Paper

This paper is intended to collate and summarise information from a range of different sources in regard to safety issues around lithium batteries. It provides information on how this may impact manufacturers and importers and in turn distributors and retail suppliers of AT and their clients.

It is not intended to be a definitive statement but rather a start to the conversation as input from ATSA's members is a key part of agreeing how ATSA should respond to the minimum safety requirements for the use of lithium batteries in Assistive Technology.

What is a Lithium-ion (li-ion) Battery?

An li-ion battery basically comprises two electrodes, that is, cathode (positive electrode) and anode (negative electrode), separated by an ionic conductive electrolyte, providing a voltage derived from the potential difference between the two electrodes.¹

There are 6 types of Lithium batteries² of which 2 are considered suitable for mobility devices*.

- Lithium Nickel Manganese Cobalt (LiNixMnyCozO2 or NMC) *
- Lithium Nickel Cobalt Aluminium Oxide (LiNiCoAlO2 or NCA)
- Lithium Iron Phosphate (LiFePO4 or LFP) *
- Lithium Cobalt Oxide (LiCoO2 or LCO)
- Lithium Manganese Oxide (LiMn2O4 or LMO)
- Lithium Titanate (Li2TiO3 or LTO)

Further information about lithium batteries can be found in [CSIRO-ACCCLithiumIonBatteries.pdf \(productsafety.gov.au\)](#) pp39-41³ and

[Lithium Ion Battery - an overview | ScienceDirect Topics](#)¹

Regulatory Environment

Currently in Australia there is no single regulator responsible for the safety of lithium batteries for consumers. According to the ACCC Safety Report, Section 9.4⁴ the burden of selecting and applying relevant safety standards lies with the manufacturer, supplier or importer of the product.

In our research, the only entity we could identify that has a program or processes for checking the safety of batteries is the Clean Energy Council⁵. The Council provides a list of batteries that have been independently tested to confirm they meet the electrical safety and quality standards under the Clean Energy Council's Battery Assurance Program.⁵

The Electrical Regulatory Authorities Council (ERAC) has a regulatory framework aimed at increasing consumer safety in household electrical equipment through the application of risk-based registration and certification requirements.³ The Electrical Equipment Safety System

has only been endorsed by state governments in Western Australia, Victoria, Queensland and Tasmania at the time of writing this report. The lack of a national system pushes more responsibility on to the ACCC to intervene in lower voltage safety incidents.³

In regard to the Standards for lithium batteries for Assistive Technology (AT), Standards Australia has published Lithium-ion batteries in wheelchairs ISO 7176-31 2023 which covers the requirements and test methods. Members should also be aware of the Australian Standard AS/NZS 4417.1 and AS/NZS 4417.2 Marking of electrical products to indicate compliance with regulations – General rules.

The expectation by the ACCC is that suppliers providing lithium batteries have complied with this standard.

Research and Safety of Lithium Batteries

The following section summarises the key points from research undertaken by the ACCC and CSIRO. We are very interested in hearing of other research into lithium batteries that may relate to Assistive Technology.

1. ACCC - Product Safety⁴

Risks of Lithium Batteries identified by the ACCC include

- If a lithium-ion battery is not correctly manufactured, handled, stored or disposed of, it can catch fire, explode or vent toxic gas.
- A lithium-ion battery fire can be very difficult to extinguish as it may reignite and depending on the battery size, sometimes takes days to burn.

Safety measures identified by the ACCC:

- Always follow the manufacturer's instructions.
- Ensure the charger you are using is suitable for the battery in the product being charged.
- Buy products that contain lithium-ion batteries from a reputable supplier.
- Follow the manufacturer's instructions.
- Store lithium-ion batteries and products in cool, dry places and out of direct sunlight.
- Allow the lithium-ion battery to cool after use and before recharging.
- Purchase replacement batteries from the original supplier or a reputable supplier where possible.
- Keep lithium-ion batteries separate from each other when removed from products.

Never:

- Use lithium-ion batteries, products or chargers that are showing signs of failure such as denting, crushing or other damage, overheating, swelling, leaking or venting gas.
- Leave lithium-ion batteries or products in hot places such as in parked vehicles
- Modify a lithium-ion battery or use it in the incorrect product
- Repurpose batteries designed for use in one product to use in another.
- Check safe disposal options at [Recycle Mate](#) or [B-Cycle](#) to safely dispose of lithium-ion batteries or products.
- Monitor charging times of devices and disconnect products from chargers once they are fully charged. Consider setting timers as a reminder to unplug devices.
- Charge lithium-ion batteries or products on non-combustible surfaces such as concrete, ceramic, or steel.

Never:

- Charge lithium-ion batteries or products on combustible materials such as beds, sofas or carpet
- Use damaged chargers or charging cables.

2. [CSIRO Lithium-ion battery safety. A report for the Australian Competition and Consumer Commission \(ACCC\) Adam S. Best, Kate Cavanagh, Christopher Preston, Alex Webb and Steven Howell May 2023 | EP2023-1783](#)³

Source: [CSIRO-ACCCLithiumIonBatteries.pdf \(productsafety.gov.au\)](#)

There are 28 recommendations in this report which cover

- Development of an Australian website providing information on smaller consumer battery products and chargers, larger home energy storage systems, electric vehicles and more.
- All lithium-ion cells are recommended to be accompanied by a battery management device or integrated circuit to assist in providing safe operating conditions
- Standards bodies and regulators should consider how to adopt and implement 4 levels of a Battery Management System (BMS). This is a critical component of any lithium-cell based battery pack which manages the performance, efficiency, and safety of the battery system. The 4 levels are based on cell manufacturer recommendations and target markets: minimum, fair, good, and excellent (reference: Table 3 of the report).
- Increasing safety around chargers by original Equipment Manufacturers (OEMs) providing accessible consumer advice.
- Strategies to reduce hazards such as directions on how to extinguish a fire, charging batteries on non-combustible surfaces, away from combustible items and consumers not modifying products with larger or additional batteries and using products in strict accordance with manufacturer guidelines and operating instructions.
- Recycling and End of Life management through using battery drop off locations and recycling centres.
- Introduction of other standards in addition to the BMS, strict enforcement of the Australian Goods Code, additional testing facilities and improved data collection.

One of the key learnings from this report for members is that when sourcing lithium batteries for AT, they should verify the manufacturer/importer has complied with all international and Australian standards. Members can also utilise the battery list managed by the Clean Energy Council –

[Approved batteries | Clean Energy Council](#)⁵

3. [Clean Energy Australia – Best Practice Guide for Storage of Lithium-ion batteries Battery Safety Guide | Clean Energy Council](#)⁶

This guide was developed by the clean energy industry associations involved in renewable energy battery storage equipment. Input was also provided by energy network operators, private certification bodies, independent stakeholder groups and consumer and electrical safety regulators.

The guide is aimed at manufacturer/importers and provides guidance on what they must do to assess their equipment in order to ensure it meets the mandatory minimum safety criteria listed in the guide. Clean Energy Australia maintain that

equipment complying with their Battery Safety Guide that is “installed and maintained in accordance with manufacturer’s instructions and standards such as AS/NZ 4509.1 *Stand-alone power systems*, AS/NZS 5139 *Electrical installations – Safety of battery systems for use with power conversion equipment* (when published) and AS/NZS 3000 *Wiring rules*, will pose a minimal risk during the equipment’s normal operation.”⁶ Part 1, 1.1.

The guide also provides definitions of battery components and diagrams showing battery storage equipment and includes a risk matrix. It does not however go into the type of batteries that are utilised in AT, namely low voltage, low capacity, portable (easily disconnected from the load).

4. Standards Australia

Standards Australia have adopted the ISO standard 7176.25 Part 31 [BS ISO 7176-31:2023 Wheelchairs Lithium-ion battery systems and chargers for powered wheelchairs. Requirements and test methods \(en-standard.eu\)](#). This standard provides detailed guidelines on the requirements and test methods for lithium-ion battery systems and chargers for powered wheelchairs. Topics covered include safety, performance and reliability and guidance on how to conduct tests to ensure these systems meet the highest standards of quality and safety.

5. Testing Lithium-ion Batteries

The 4 methods of testing a lithium-ion batteries are

- (1) Observation. The following signs are high level warnings:
 - b) Frequent overheating - compare the temperature of the battery to the manufacturer’s normal operating temperature range and if it is higher - replace immediately.
 - c) Swelling or bloated body - battery should be replaced immediately.
 - d) Strange smell, discoloration - battery should be replaced immediately.
- (2) Capacity tests
- (3) Discharge tests
- (4) Voltage tests.

Questions for Suppliers to ask Manufacturers/Importers of Lithium-ion Batteries

What questions should a supplier ask to reduce risks in the purchase of assistive technology which uses a lithium battery? Based on the resources above, the following are some suggested questions for suppliers to ask of importers/manufacturer of lithium-ion batteries.

The following have been drafted by ATSA and the member representatives for Standards Australia - our thanks go to Samuel Baker (Permobil) and Steve Teuma (Newcastle Mobility).

1. Evidence through a Test Report showing the battery is compliant with ISO 7176-36 Part 31 Wheelchairs - Battery systems and chargers for powered wheelchairs. Requirements and test methods. Link to purchase this standard is [ISO 7176-31:2023 - Standards Australia](#)
2. For all AT the battery should comply with UN 38.3: Transportation Testing for Lithium Batteries and Cells and IEC 62133-2:2017+AMD1:2021 Secondary cells and batteries containing alkaline or other non-acid electrolytes-Safety requirements for portable

sealed secondary cells, and for batteries made from them, for use in portable applications-Part2:Lithium systems.

3. What kind of lithium battery does the device use? A Lithium Iron Phosphate battery is preferred over any Lithium Polymer based batteries.
4. Does the battery have its own Battery Management System (BMS)? Note – positive answers to questions 1 and 2 would make the battery compliant with ISO 7176-31 2023 for wheelchairs.
5. There should be evidence of the BMS complying with electrical safety compliance (e.g., AS/NZS 3820:202, AS/NZS 60335.1 2022) and EMC compliance (AS/NZS 61000, CISPR-11, CISPR-14).
6. Is the battery registered on the EESS⁷ or does it have an SAA certificate?
7. Does the product have Revenue Cycle Management marking?
8. For suppliers conducting repairs and maintenance – can the manufacturer advise any performance standards to be used for the battery?
9. What thermal runaway protection is used in the battery? Aim is to have each cell isolated from others to minimise risk of a fire spreading to multiple cells or outside the battery itself.
10. Does the battery have the Australian regulatory compliance mark (a tick within a triangle, note this is recognised by state governments in Victoria, Western Australia, Tasmania and Queensland)? If not, the battery is likely to be non-compliant. The onus is on the importer to ensure they have evidence the battery is safe.
11. Is the battery on the Clean Energy Australia list of approved batteries? [Approved batteries | Clean Energy Council](#) ⁵
12. Ask the importer or manufacturer for the information /fact sheet for consumers on how to keep lithium batteries safe so that you can provide this to your clients. This should include the following which has been sourced from 6.3 Recommendations in the ACCC Product Safety Report ³:
 - How to select, use and store lithium-ion batteries safely
 - How to tell when the safety of the battery is compromised and
 - Practical steps and mitigation strategies to keep safe.

Note: The AT devices themselves must adhere to electrical safety standard AS/NZS 60335.1:2022 Household, and similar electric appliances – Safety general requirements. Also, there is still a requirement of the EESS⁷ and other schemes for evidence of electrical safety for low voltage electrical equipment.

Draft Information Sheet for Discussion with Clients

The following is intended to be a guide only to help members in their discussions with clients and to enhance the information provided by manufacturers/importers. This list has been sourced from ACCC Product Safety Report p37.⁴

- ❖ “Ensure the charger is suitable for the battery in the product being charged.
- ❖ Monitor charging times and disconnect batteries from chargers as soon as they are fully charged (consider timers as a reminder to unplug devices)
- ❖ Do not use batteries or devices if products are overheating or showing signs of failure such as swelling, leaking or venting gas. In these cases, place leading or damaged batteries in a clear plastic bag (after they have cooled down) and contact your local council for disposal options.” *Note you may want to ask your clients to contact you as the supplier.*
- ❖ “charge batteries and devices away from combustible materials (such as beds, sofas or carpet)
- ❖ Store batteries and Li-ion battery products such as e-scooters in cool, dry places and out of direct sunlight, including while charging
- ❖ Allow time for batteries to cool down after use and before recharging.”

Acknowledgements

I extend my sincere appreciation to Samuel Baker, Permobil for his expertise and guidance in the writing of this Information paper. I would also like to acknowledge Steve Teuma, Newcastle Mobility for his valuable insights and feedback and Matthew Butterworth and Paul Hogan for their expertise and editorial advice.

References

- ¹ Polymer Materials for Energy and Electronic Applications, 2017¹[Lithium Ion Battery - an overview | ScienceDirect Topics](#)[Lithium Ion Battery - an overview | ScienceDirect Topics](#)
- ² [The Six Main Types Of Lithium-Ion Batteries | Xerotech](#)
- ³ [CSIRO-ACCCLithiumIonBatteries.pdf \(productsafety.gov.au\)](#)
- ⁴ [Lithium-ion Batteries report 3 0.pdf \(accg.gov.au\)](#)
- ⁵ [Approved batteries | Clean Energy Council](#)
- ⁶ [Battery Safety Guide | Clean Energy Council](#)
- ⁷ [www.eess.gov.au](#)

Additional Resources:

IATA Guidance to transport of battery powered mobility aids [mobility-aid-guidance-document.pdf \(iata.org\)](#)