

Lithium-ion Batteries – Portable Tools

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The use of lithium-ion battery powered tools is commonplace in many workplaces. As with any battery equipment, fires can occur, however the risk of a significant loss can be greatly reduced by adoption of simple precautions.

This Loss Prevention Standard provides guidance to help businesses identify, and mitigate the risks associated with the use of portable tools in the workplace.



Introduction

Lithium-ion battery powered tools are prevalent in the workplace, whether used as part of key manufacturing processes, used for occasional property maintenance, or bought on to site by contractors. Whilst generally safe and reliable, the use of tools containing lithium-ion batteries in the workplace introduces a fire hazard that, as with any energy generating equipment, requires management to help reduce the potential for fire events.

This Loss Prevention Standard discusses some of the main concerns and provides general guidance that can help reduce the potential for significant loss and consequences to business trading.

This document is one of a series of battery related Loss Prevention Standards. A General Considerations Loss Prevention Standard provides an overview of the main risks related to lithium-ion battery powered equipment usage, and strategies for minimising loss. Other documents in the series provide guidance for specific battery applications or settings.

Note: This standard is not intended to address Liability exposures. It focusses on Property loss prevention and related risk management guidance. Companies retailing or storing significant numbers of lithium-ion battery powered tool stock should refer to Aviva Loss Prevention Standard – [Lithium-ion Batteries: Transit and Storage](#).



Understanding the Risks

The risk of fire involving good quality, undamaged lithium-ion tool batteries, is low. The fire risk however increases significantly when aged, poorly manufactured, misused, modified, or damaged batteries are used; are paired with incompatible tools or poor-quality charging equipment; or are used in incompatible environments e.g., high, or significantly low temperatures. Damaged or faulty batteries can become unstable often resulting in thermal runaway, a condition that can result in:

- Off-gassing: large volumes of toxic and flammable gases can be generated and released during thermal runaway.
- Fire: Due to energy being stored within a very compact space, ignition of gases during thermal runaway can cause rapid developing fires.
- Vapour cloud explosion: Unburnt gases form a cloud that, with a suitable ignition source, can explode, especially in enclosed spaces. The cloud often appears as white 'smoke'.

Fire can also spread to other combustible materials in proximity and other batteries on charge prolonging the fire event and increasing the potential for fire and smoke damage. The consequences of fire include expensive clean-up operations; impacts to trading, as well as impacts to Environmental, Social and Governance (ESG) programmes.

General Considerations

The following areas should be fully considered:

- Risk Assessments – Ensure relevant risk assessments including Fire Risk Assessment and where applicable, Explosion/DSEAR Risk Assessment have been reviewed to address the presence of Lithium-ion battery powered tools and equipment, and any remedial or corrective actions implemented.
- Inform your Insurer and Broker – Significant changes to business activities, risk exposures, and risk control measures relating to the use of lithium-ion batteries should be discussed with your Insurer and Broker, who can provide risk management advice and guidance.
- Site Rules – Ensure the site rules regarding use, handling, charging, disposal, training, site inspections, authorisation, training, emergency arrangements etc., are recorded e.g., within Standard Operating **Procedures (SOP's)**, and shared with relevant staff and contractors etc.
- Self-Inspection - The batteries, charging equipment and charging area/cabinet/room should be subject to a regular, recorded inspection programme to help identify damage, modifications, use of aftermarket or incompatible batteries or accessories, housekeeping concerns, fire detection/protection impairments and adequacy of charging arrangements.
- Thermographic camera inspections can also prove invaluable for such inspections. They can also be used to check for hot spots or overheating of batteries whilst on charge.
- Emergency Response - an emergency response plan outlining key responsibilities and actions in an emergency incident involving Lithium-ion tool batteries.
- Fire Protections – Storage and charging should be undertaken in an area of the premises covered by the automatic fire detection and fire protection systems, where installed.

Storage and Charging Locations

When deciding the most appropriate storage/charging locations, several factors should be considered within a risk evaluation:

- Number of appliances – Increased numbers of batteries under charge increase the potential for fire growth, heat output and ultimately fire spread to other contents and the building.
- Fire Load – The combustibility of other materials in proximity and internal building surfaces, and the potential for fire spread to those materials and surfaces.
- Compartmentation – Would the fire be contained to the compartment of origin, or could it spread unimpeded throughout the building?
- Fire protections – Are the premises sprinkler protected or are other active fire protections installed? Are they adequate for the proposed charging activities?
- Impacts of fire – How would a fire impact business activities? Even a small incident could significantly affect trading.
- Charging times – Charging tool batteries when the premises are unoccupied can result in delays to Fire and Rescue Service attendance and worsen the scale and size of the loss.

Once the potential scale of fire damage and the impacts to trading activities are evaluated, the most appropriate means of managing risk exposures can be considered.

Note: It is important that where any consideration is being given to the storage and/or charging of batteries that any additional risks posed must be fully assessed, with consideration given to the use of the building and its layout and be subjected to review within the premises Fire Risk Assessment.

Segregation Only

Segregation of tool battery storage/charging activities from other business activities in a single communicating work area, rather than containment within dedicated fire resisting rooms or cabinets, is not recommended and should only be considered where/when:

- The risk is limited to a small number of lithium-ion tool batteries on charge.
- Batteries and charging equipment are in good working order with no signs of damage or age-related concerns.
- The batteries are stored/charged on, and/or against a non-combustible surface, e.g., metal bench, wet masonry construction, gypsum plaster on plasterboard etc.
- Combustible goods or materials are maintained at least three metres clear, in all directions, to storage/charging areas and warning signage to this effect has been placed in proximity. Demarcation of the charging area using hatching or physical barriers is recommended.
- The area is routinely inspected for breaches of storage/charging rules.
- The premises are occupied.
- The area is adequately ventilated.
- Supported by a risk assessment/evaluation.

The storage and charging of multiple tool batteries is not recommended unless within a fire resisting compartment or cabinet.

Proprietary Storage/Charging Cabinets

In most cases a [proprietary storage/charging cabinet](#) should be considered, and which should be:

- Specifically designed for the storage and charging of rechargeable/lithium-ion batteries.
- Independently tested and approved by a third-party accredited testing organisation and rated to provide a defined fire resistance period of at least 60 minutes.
Note: increased fire resistance periods are available if preferred.
- **Located in a defined 'safe' area of the premises, preferably a separate fire compartment but** otherwise remote from combustible building linings; at least two metres clear of combustible goods, traffic movements and hazardous trading activities. Demarcation using hatching to specify clearance distances is recommended where possible. Additional impact protection may be necessary in areas with significant vehicular movements e.g., lift trucks etc.
- Fitted with overcharge isolation devices.
- Adequately ventilated.
- Subject to appropriate electrical appliance testing of charging equipment.

Other Cabinets

The use of non-fire resistance rated storage/charging cabinets is not recommended and should only be considered where:

- The risk is limited to one or two lithium-ion battery powered tools.
- The cabinet is itself non-combustible and located on and/or against a non-combustible or fire resisting surface e.g., metal bench, wet masonry construction, gypsum plaster on plasterboard etc.
- Combustible goods or materials are maintained at least three metres clear, in all directions, and warning signage to this effect placed in proximity.
- Demarcation around the charging cabinet using hatching or physical barriers is recommended, and the area routinely inspected for breaches of storage rules.
- The premises are occupied.
- Any opening for cables etc., should be fitted with protective grommets to prevent chafing to cables and potential electrical shorting and/or electric shocks.
- The area is adequately ventilated.

The charging of multiple tool batteries is not recommended unless within a fire resisting compartment or cabinet.

Storeroom

The use of a separate fire compartment for storing/charging tool batteries is also recommended and should be:

- Of non-combustible construction providing a fire resistance rating, including the ceiling of at least 60 minutes and,
- Fitted with an appropriately tested and accredited fire door, providing at least 60 minutes fire resistance, and kept closed when not in use. Any windows present should also be fire resistance rated to at least 60 minutes and any openings or voids fire stopped.
- Maintained clear of other combustible goods or maintained at least three metres clear of storage and charging areas, in all directions.

Increased fire resistance ratings of 90 to 120 minutes should be considered where significant number of tool batteries are stored or on charge, or where recommended/supported by a risk assessment/evaluation.

Contractors Equipment

Ideally any contractor's tools should be charged in line with the guidance provided above. Additionally, Permit to Work management policies and Permits should be extended to include checks to lithium-ion battery powered tools to ensure they are in good working condition, with no visible signs of modification or damage. The contractor should also be able to confirm power tool batteries are within their recommended lifecycle rating, or less than three years old. Batteries exceeding three years of age are likely to be nearing end of life and Permit Issuers should be given the authority to prohibit their use if they have any concerns regarding working condition and fire safety.

Damaged or Faulty Batteries

Damaged or faulty tool batteries should be removed from use and segregated/quarantined pending removal or collection by a reputable waste recycling company. Segregation/quarantine should be external and as far away from buildings, valuable assets, and combustible goods as possible (in most cases at least 3 metres separation is recommended for single tool batteries).

Note: Internal storage of damaged or faulty batteries is not recommended unless within a dedicated storeroom of non-combustible construction providing a fire resistance rating, including the ceiling of 90 to 120 minutes.

Damaged batteries should not be deposited with other general waste under any circumstances.

End-of-Life Battery Management

All rechargeable batteries have a recommended lifecycle rating. The recommended life of lithium-ion batteries is also affected by the depth of discharge, or **the amount of a battery's storage capacity that is utilised**. This information will be available in the product specifications.

You should not exceed recommended lifecycle charging, and replacement batteries and accessories should only be sourced from the original manufacturer of the equipment (OEM) or an official agent of the manufacturer.

Batteries that have reached end-of-life should be clearly labelled and stored separately to avoid re-purposing and collected by a reputable waste recycling company.

Fire Extinguishers

Fire extinguishers specified for use in tackling lithium-ion battery fires are available. These appliances are not currently compliant with British Standard BS5306: Fire Extinguishing Installations, and whilst potentially providing some benefit require very early application and, are unlikely to fully extinguish a developing fire involving lithium-ion batteries or prevent the batteries reigniting. The volatility of lithium-ion battery fires and their explosive characteristics also present significant injury risks to persons tackling such a fire in proximity, and as such their use should be carefully considered within the premises Fire Risk Assessment.

Key Action Steps

- Ensure the Fire Risk Assessment has been reviewed to include use and charging of lithium-ion battery powered tools.
- Write clear rules for personnel and contractors, within Standard Operating Procedures where necessary.
- Ensure safe storage and charging measures are in place to minimise the risk of fire damage in the event of ignition. Contain internal charging and storage in fire rated enclosures (cabinets and compartments) if possible.
- Prohibit the use of aftermarket, non-OEM, modified or recycled/re-purposed batteries and associated equipment.
- Complete regular self-inspections to ensure equipment is in good order. Use thermographic cameras.
- Adopt contractor equipment checks and rules. Prohibit damaged, modified, and aged equipment.
- Isolate damaged, faulty and end of life batteries and arrange for prompt collection by reputable waste company.
- Introduce emergency procedures and provide appropriate training to staff and contractors.
- Ensure fire detection systems and other fire protections are appropriate.

Checklist

A generic [Battery Checklist](#) is available, which can be tailored to organisation's needs.

Specialist Partner Solutions

Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners, including:

- Fire risk assessment: [Cardinus Risk Management](#)
 - Charging cabinets: [Denios](#)
 - Thermographic imaging and PAT testing: [PASS](#)
 - Automatic fire detection and portable extinguishers: [SECOM](#)
- For more information please visit: [Aviva Risk Management Solutions – Specialist Partners](#)

Sources and Useful Links

- [The Regulatory Reform \(Fire Safety\) Order 2005.](#)
- [The Fire Safety \(Scotland\) Regulations 2006.](#)
- [The Fire \(Scotland\) Act 2005.](#)
- [The Fire and Rescue Services \(Northern Ireland\) Order 2006.](#)
- HSE document INDG139 [Using electric storage batteries safely.](#)
- [RiscAuthority document RC61 Recommendations for the Storage, Handling, and use of Batteries.](#)
- [RiscAuthority document RE2 Need to Know Guide Lithium-ion Battery Use and Storage.](#)

Note: Whilst UK standards and legislation are referenced in this document, other international standards and legislation should be referenced where applicable.

Additional Information

Relevant Loss Prevention Standards include:

- [Fire Compartmentation.](#)
- [Fire Doors, Fire Shutters & Fire Dampers.](#)
- [Fire Safety Inspections.](#)
- [Fire Safety Legislation.](#)
- [Thermographic Surveys.](#)

To find out more, please visit [Aviva Risk Management Solutions](#) or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666.*

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