

Planning a Battery Energy Storage System – 12 Top Tips

Small scale Battery Energy Storage Systems (BESS) are typically used by organisations to manage energy usage/efficiency and meet Environmental, Sustainability and Governance (ESG) goals.

The batteries used in BESS can however create added fire and explosion hazards, and this Loss Prevention Standard provides 12 Top Tips to consider during the planning phase to help reduce the potential for such loss or damage.

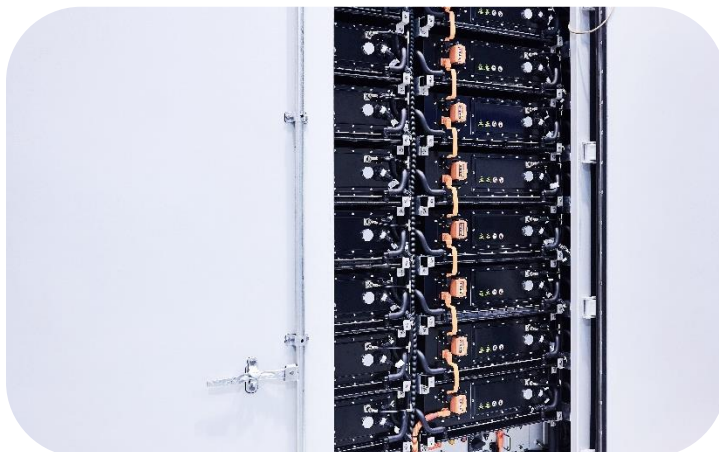
Planning a Battery Energy Storage System – 12 Tops Tips

Introduction

Battery Energy Storage Systems (BESS) are used to capture and store energy, whether electrical power purchased from the grid at lower demands for later use, or from renewable energy sources such as photovoltaic solar panel systems.

This document provides useful guidance to help prevent fires and other losses or damage in relation to small-scale lithium-ion BESS located on business premises.

Note: This document is focussed on Property loss prevention in relation to the external installation of small-scale lithium-ion battery BESS. Indoor BESS are addressed in **Small Scale Battery Energy Storage Systems** and grid scale BESS installations are addressed in Aviva Loss Prevention Standard **Grid Scale Battery Energy Storage Systems**. This document is not intended to address liability exposures, nor BESS featuring other battery technologies, although much of the guidance provided will be relevant. The presumption is that all regulatory requirements, Fire Risk Assessments, and compliance with requirements placed by the local authority having jurisdiction which would include licencing, building permissions, regulations, codes, or standards, have or will be met.



Understanding the Risks

Whilst proprietary BESS, installed and maintained in accordance with manufacturers' guidelines and national or local regulations, standards or codes are generally safe and reliable to use, the risks need to be considered and include:

- **Thermal Runaway Ignition.** Batteries can spontaneously enter thermal runaway for a number of reasons including manufacturing defects, weathering, external damage, or overheating. Thermal runaway is a self-sustaining chemical combustion reactions of the battery contents, as such it cannot be extinguished by conventional suppression means.
- **Gas Venting.** A lithium-ion battery fire is generally preceded by gas venting, whereby a pale-coloured vapour cloud emanates from the affected cells. This cloud is highly flammable, containing a high degree of hydrogen and hydrocarbons, as well as acutely toxic due to a mixture of hydrogen cyanide, hydrogen fluoride, and others capable of severe respiratory damage. If ignited under pressure, this can also result in a deflagration known as a vapour cloud explosion.
- **Fire.** Battery fires generate extreme heat, which can ignite combustible materials metres away, as well as induce a chain thermal runaway reaction in battery cells nearby. Attempts to extinguish fires involving large numbers of lithium-ion batteries can take many hours, as illustrated by [this incident in 2020](#), with possible spontaneous reignition if the battery's potential energy has not been depleted. Fire can also spread to nearby buildings and other property.

- **Contamination.** The combustion products released during a fire are highly corrosive, and can damage nearby buildings, assets, and the local environment. As a result, contaminated firefighting water requires careful management to help control damage, which generally comes at very high cost.
- **Business Interruption.** Fires involving BESS can be disruptive to business activities with premises requiring decontamination and replacement of contaminated stock and equipment. Radiant heat damage can also cause further damage to the fire's surroundings.

Refer Aviva Loss Prevention Standard **Contamination Following a Fire** for further guidance.

Managing the Risks

1. Management of Change

Ensure the planning, design and installation work is managed under a Management of Change programme and all relevant stakeholders are involved in design, planning and installation discussions.

- Close project management significantly helps to reduce the potential for errors, delays, expensive rectifications, and unplanned changes.

Refer Aviva Loss Prevention Standard **Managing Change - Property** for guidance.

2. Consult with your Insurer and Broker

Discuss any plans to install BESS with your insurer and broker as soon as possible. They can provide helpful guidance to reduce the potential for material damage, business interruption and environmental damage.

3. Risk Assessment

Regulatory risk assessments should be reviewed to consider the planned BESS and identified risk control measures implemented.

Refer to the Aviva Loss Prevention Standard **Fire Safety Legislation** for further guidance.

An assessment of the anticipated/possible financial losses, for both the material damage and business interruption exposures, in the event of a significant loss event should also be undertaken prior to approving design specifications. This helps ensure that risk controls are sufficient and reflective of the potential property loss estimates.

Note: The risk assessment should not recognise any form of local fire suppression systems within BESS enclosures and should assume any battery fire will be free burning until depleted.

Refer to the Aviva Loss Prevention Standards **Material Damage Risk Assessment** and **Business Impact Analysis** for further guidance.

4. Fire and Rescue Service

Discuss the planned BESS with your local Fire and Rescue Service. They can provide guidance and also consider their emergency response, including water supplies; containment of contaminated firefighting water; evacuation measures, etc.

5. System Features

Detailed design guidance including an overview of testing standards is provided in Aviva Loss Prevention Standard **Small Scale Battery Energy Storage Systems**. Main considerations include, but are not limited to:

- The BESS should be manufactured by a reputable and experienced company, and tested/certified to be compliant with established safety standards.
- All BESS enclosures should be of non-combustible construction with any insulation materials also rated as non-combustible.
- Foundations should be suitable for the weight of the BESS and local conditions.
- A good quality Battery Management System (BMS) should be utilised and configured to safely isolate the BESS if high temperature thresholds are reached, or other hazardous performance characteristics that could lead to a thermal runaway event.
- Ensure any passive explosion venting is directed towards a safe location and will not be impeded and conforms to **NFPA 68: Standard on Explosion Protection by Deflagration Venting**.
- Automatic ventilation in container type enclosures should be rated as suitable for use in explosive atmospheres and interlocked to the BMS and/or gas detection to activate upon detection of early gas release or faults identified by the monitoring equipment and conforms to **NFPA 69: Standard on Explosion Prevention Systems**.

Note: Smaller cabinet type BESS will generate significantly less explosive potential and may utilise air circulation fans. These should however be rated and suitable for use in potentially explosive environments and provided with adequate air circulation.

- The BESS system controller should be monitored and configured to alert key personnel in the event of any reported performance discrepancies or deviations.
 - ✓ Ensure incidents will be reported to responsible persons as soon as possible and response procedures are formalised and understood.
 - Prompt response to potential faults can result in safe isolation of the BESS and potentially avoidance of loss events.
- BESS should be protected against the risks of lightning damage including surge and transient surge.

Refer to the Aviva Loss Prevention Standard **Lightning Protection** for further guidance.

6. Installer

Ensure competent and experienced installers are utilised.

- Electrical engineers should be qualified to install and maintain electrical systems in compliance with national regulations, standards, or codes. In the United Kingdom this is **BS 7671: 2018 Requirements for Electrical Installations IET Wiring Regulations (18th Edition)**.
- Specific electrical energy storage systems training courses are available to qualified electrical engineers, and the installers should be asked to provide certification.

7. Location

The BESS should be located externally and at least 10 metres separation maintained between the BESS and other buildings or critical assets. In addition:

- At least 4.5 metres separation should be maintained between any other container type BESS.
- At least 1.5 metres separation should be maintained between BESS enclosures and associated inverters and controller units.
- The area between the BESS and other buildings and assets should be maintained clear of combustible items, e.g. waste stores, pallets, vehicles, etc.

Important: Where an internal BESS location is planned, or where the recommended separation distances above cannot be achieved, discuss with your insurer and broker.

8. Maintenance and Inspection

BESS equipment will need to be serviced and maintained in accordance with Original Equipment Manufacturer (OEM) and/or system installer guidelines/instructions.

- Formal servicing and maintenance plans should be arranged with the installer at the recommended frequencies following installation.
- Ensure a self-inspection programme is formalised following installation. The Aviva document **Small Scale Battery Energy Storage Systems - Checklist** provides guidance on the items to be checked/inspected.

Refer to Aviva Loss Prevention Standards **Maintenance Regimes** and **Self-Inspections** for further guidance.

9. Detection and Protection

An automatic gas detection system, designed for the detection of lithium-ion battery off gassing, should be installed within container type BESS enclosures as per manufacturer guidelines, but normally near the battery racks and air ventilation systems. .

- Such detection systems should be interlocked to the power supply and charging systems to isolate upon the immediate detection of gases.
 - ✓ Ensure regular interlock testing is undertaken – at least annually is recommended.
- An accredited fire protection installer can provide further guidance and assistance.
- Water based or gaseous fire suppression systems are not typically recommended within BESS enclosures. Guidance on the suitability of any planned suppression systems should be obtained from your insurer and broker.
- Fire extinguishers specified for use in tackling lithium-ion battery fires are available, however the volatility of lithium-ion battery fires and their explosive characteristics presents significant injury risks to persons tackling such a fire in proximity, and as such their use is not recommended within BESS enclosures.

Refer to Aviva Loss Prevention Standard **Fire Extinguishers** for further guidance.

10. Security

Ensure the site security arrangements are adequate.

- The BESS should not be freely accessible to members of the public and security fencing may be necessary.
- The BESS enclosure and other external equipment, e.g., inverters, etc., should be adequately secured to prevent unauthorised access.
- Is a Video Surveillance Systems (VSS) necessary or will existing VSS need to be extended to cover the BESS?
- Do cyber security exposures need to be reviewed to ensure appropriate protections and procedures are incorporated including data access approval management.

Refer Aviva Loss Prevention Standards **Video Surveillance Systems - Introduction** and **Cyber Security - Top 12 Tips to Protect Against Cyber Attacks** for further guidance.

11. Emergency Response

- Arrangements should be formalised for the response to any fault reporting, including:
 - ✓ Isolating the BESS pending formal inspection and repair.
 - ✓ Maintenance company call outs arrangements.
 - ✓ Immediate removal of faulty, damaged or replaced cells from the premises.
 - ✓ When and who notifies emergency services.
 - ✓ Details of the battery types.

Note: Battery details should be provided in emergency fire packs or boxes for Fire and Rescue Service use should they need to attend a fire at the premises.

Refer to Aviva Loss Prevention Standard **Emergency Response Teams** for further guidance

12. Business Continuity

Review Business Continuity Plans to ensure disaster recovery and continuity arrangements. Any actions generated should be addressed promptly.

Refer to Aviva Loss Prevention Standard **Business Continuity** for further guidance.

Specialist Partner Solutions

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- Portable extinguishers: [SECOM](#)
- Business continuity: [Horizonscan](#)

For more information please visit: [Aviva Risk Management Solutions - Specialist Partners](#)

Sources and Useful Links

- [BS EN 62305 - Protection against lightning](#)
- [BS 7671: 2018 Requirements for Electrical Installations IET Wiring Regulations \(18th Edition\).](#)
- [UL 9540 Energy Storage Systems and Equipment](#)
- [UL 9540A Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems](#)
- [NFPA 855 - Standard for the Installation of Energy Storage Systems](#)
- [NFPA 68 Standard on Explosion Protection by Deflagration Venting](#)
- [NFPA 69 Standard on Explosion Prevention Systems](#)
- [FM Property Loss Prevention Data Sheets 5-33 lithium-ion Battery Energy Storage Systems](#)
- Risc Authority document [RE1- Battery Energy Storage Systems - Commercial Lithium-Ion Battery Installations.](#)

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

Additional Information

Relevant Aviva Loss Prevention Standards include:

- **Small Scale Battery Energy Storage Systems**
- **Battery Energy Storage Systems - Checklist**
- **Business Continuity**
- **Contamination Following a Fire**
- **Maintenance Regimes**
- **Self-Inspections**
- **Managing Change - Property**
- **Smoke Contamination**
- **Video Surveillance Systems - Introduction**
- **Cyber Security - Top 12 Tips to Protect Against Cyber Attacks**
- **Cyber Security - Ransomware**

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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