

Loss Prevention Standards – Asset Class(es)

Battery Energy Storage Systems – Checklist

Version: 1.0

Date: 16th December 2024

This checklist can be used to support the design, installation, and ongoing care and management of Battery Energy Storage Systems.



Battery Energy Storage Systems – Checklist



Location	
Date	
Completed by (name and signature)	

	General Considerations	Y/N	Comments
1.	Are the design and installation companies, and any third party contractors, reputable and experienced in BESS design and installation projects?		
2.	<ul style="list-style-type: none"> Are the electrical engineers qualified to install and maintain electrical systems in compliance with national regulations, standards, or codes? <p>(Note: In the United Kingdom this is BS 7671: 2018 Requirements for Electrical Installations IET Wiring Regulations (18th Edition).</p> <ul style="list-style-type: none"> Have the electrical engineers undergone any specific electrical energy storage systems training courses? Have certificates been provided to evidence the above? 		
3.	<ul style="list-style-type: none"> Has the BESS systems and associated components been manufactured and tested to be compliant with safety standard UL 9540: Energy Storage Systems? Has the system also been tested using test standard UL 9540A: Evaluating Thermal Runaway Response, and the results incorporated into the system design? Is the system suited for the type and size of the installation? 		
4.	Has the BESS been installed in accordance with national or international regulations, standards, or codes, such as NFPA 855 – Standard for the Installation of Energy Storage Systems, NFPA 68 – Passive Explosion Mitigation, NFPA 69 – Standard on Explosion Prevention Systems?		
5.	Are all BESS enclosures of non-combustible construction with any insulation materials also rated as non-combustible and achieving a fire resisting rating (insulation and integrity) of 120 minutes?		

6.	Are BESS enclosures located on foundations which have been designed by a competent person and deemed suitable for the specific location, factoring in site ground and water conditions?		
7.	Has the BESS installation been managed via a formal Management of Change process?		
8.	Have your BESS Insurer and Broker been advised of the BESS installation?		
9.	<ul style="list-style-type: none"> Has an emergency response plan been produced to outline key responsibilities and actions in an emergency event? Have the emergency response rules been formally documented, and appropriate training provided? 		
10.	<ul style="list-style-type: none"> Has a formal Business Continuity Plan been produced? Have any actions generated should be addressed promptly? 		

	Specific Design Considerations	Y/N	Comments
11.	Has at least 3 metres separation been maintained between the BESS enclosures in an installation? (Note: 4.5 metres separation is recommended where achievable)		
12.	Has at least 1.5 metres separation been maintained between BESS enclosures and inverters and Medium Voltage (MV) transformers?		
13.	Has at least 10 metres separation been maintained between BESS enclosures and switchgear rooms; High Voltage (HV) Transformers; back-up generators; fuel tanks; electrical vehicle charging facilities; sprinkler tanks and sprinkler equipment, waste enclosures, compactors, pallets stores, smoking shelters?		
14.	<p>If adequate separation cannot be achieved, has:</p> <ul style="list-style-type: none"> The site layout configuration been reviewed, and enclosures removed to increase the fire separation, or The site layout adjusted by grouping the BESS enclosures with smaller separation distances and separating these groups by the recommended spatial distance, or Where the configuration of the site layout cannot be changed, have fire barriers been installed between the BESS and the adjacent enclosures or assets? 		
15.	<ul style="list-style-type: none"> Are any building heating and ventilation system inlets sited within 10m proximity to the BESS installation? 		

	<ul style="list-style-type: none"> If so, will these be relocated? 		
16.	Is the area between the BESS enclosures and other buildings, plant etc., maintained clear of vehicles, combustible items etc., to prevent the risk of fire bridging?		
17.	<ul style="list-style-type: none"> Are any BESS installations installed in close proximity to critical overhead electrical or telecommunications lines, equipment, or poles? If so, will these be relocated? 		
18.	<p>Where the BESS is sited internally:</p> <ul style="list-style-type: none"> Is the BESS housed in a dedicated fire compartment with at least 120 minutes fire resistance rating (insulation and integrity)? Are openings for pipework, ducting, services etc., adequately fire-stopped? Do fire shutters meet approval standards and are installed by suitable accredited and competent companies? Do any external openings, such as windows etc., create a potential for vertical fire spread across the external fascia of the building? If so, will automatically operating fire shutters be installed? Is BESS compartment maintained clear of other contents? If not, will this be rectified? In addition to any systems installed to the BESS, has the need for additional active or passive ventilation and explosion relief systems been assessed within the fire compartment by a suitably competent person or consultant within an explosion/DSEAR assessment, and any recommended actions implemented? Has the buildings automatic fire detection system been extended to the BESS compartment? Are any existing sprinkler heads within the BESS compartment isolated and drained? Have the cooling/heating systems been configured to automatically operate prior to recommended battery temperature thresholds being met? Are heating/ cooling systems suitably rated for use in potentially explosive environments? If the BESS itself is not fitted with a suitably fire/explosion rated gas detection system, has this been installed within the BESS compartment? Is the gas detection system interlocked to the power supply and charging systems to isolate upon the immediate detection of gases and prior to thermal runaway? 		

	(Note: Any plans to install a BESS internally should be discussed with your Property/BESS Insurer and Broker).		
19.	<ul style="list-style-type: none"> Is the hard standing for the BESS installation non-combustible and suitable for the weight of the system? Has a geotechnical report been completed by a competent engineer/company and the landing pad built to the recommended specifications? 		
20.	<ul style="list-style-type: none"> Is the BESS located in close proximity to any watercourses or areas of environmental importance? If so, have the exposures been risk assessed and mitigations and risk control measures implemented? 		
21.	<ul style="list-style-type: none"> Is cabling located in back filled cable ducting underground? Where this is not achievable, has appropriate cable trunking/trays been utilised and located in areas where the risks of damage are minimised and suitably protected? 		
22.	<p>Are the inverters adequately IP rated for external use and not unduly exposed to harsh weather conditions or impact damage from vehicles and other moving plant?</p> <p>(Note: UL1741 Safety of Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources sets out the manufacturing (including software) and product testing requirements for inverters used for grid connection applications).</p>		
23.	<ul style="list-style-type: none"> Are transformers manufactured, tested, and installed to BS EN IEC 60076 - Power Transformers? 		
24.	<ul style="list-style-type: none"> Is the BESS be protected against the risks of lightning damage including surge and transient surge? Has a lightning risk assessment been completed by a competent person or company, preferably a member of a recognised quality scheme or body? 		

	Cooling Systems	Y/N	Comments
25.	<ul style="list-style-type: none"> • Are the enclosure and battery racks cooled evenly to help prevent hot spots developing? • Are thermographic cameras used to help identify cooling issues within the enclosure? 		
26.	<ul style="list-style-type: none"> • Are the cooling systems powered by the BESS system? • If so, will this be rectified? <p>(Note: The cooling systems should have separate and autonomous power).</p>		
27.	<p>If any air cooled systems are utilised:</p> <ul style="list-style-type: none"> • Has an environmental temperature control system been installed, which provides heating and cooling to maintain a stable temperature in accordance with the BESS manufacturers recommendations? <p>(Note: This is needed if your BESS installation is sited in a cold environment).</p> <ul style="list-style-type: none"> • Are the batteries adequately cooled? • Is a formal housekeeping regime in place to clean and replace air filters regularly? • Is the BESS enclosure regularly inspected to ensure moisture levels are appropriate and no wear or corrosion is developing? • If moisture levels are higher than anticipated, have the installers undertaken a cause and effect analysis and will rectify the issue promptly? • Are any moisture damaged components replaced promptly? 		
28.	<ul style="list-style-type: none"> • Are dust levels/accumulations monitored and BESS enclosures cleaned as necessary to ensure a sterile environment is maintained? 		

	Control Systems	Y/N	Comments
29.	<ul style="list-style-type: none"> • Is a good quality BMS utilised? • Does the monitoring system include: <ul style="list-style-type: none"> ✓ Real-time monitoring of the main parameters such as voltage, current, and temperature of the battery cells via module fan speed? ✓ Monitoring of the charging/discharging processes? ✓ Charge balancing ensuring the battery cells are charging uniformly, improving battery performance, and ensuring uniform battery balancing within the enclosure? ✓ Safety Protections to prevent overcharge and discharge issues, overcurrent, and thermal management? ✓ Data Sharing? 		
30.	<ul style="list-style-type: none"> • Has the BMS been configured to safely isolate the BESS if prescribed high temperature thresholds are achieved, or other hazardous performance characteristics are indicated that could lead to a thermal runaway event, e.g. increased resistance? 		
31.	<ul style="list-style-type: none"> • Is the BESS monitored and configured to alert key personnel in the event of any reported performance discrepancies or deviations? • Is there communications redundancy e.g. dual transmission systems? 		

	Ventilation	Y/N	Comments
32.	<ul style="list-style-type: none"> Does the BESS feature either active or passive forms of ventilation? <p>(Note: Small scale BESS enclosures 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).</p>		
33.	<p>Where active ventilation is utilised:</p> <ul style="list-style-type: none"> Is the ventilation 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 potential faults identified by the monitoring equipment? Is the ventilation powered independently of the BESS enclosure, and additional back-up power provided to ensure autonomous operation in the event of an off gassing event? Is the ventilation system continuous and not actuated or stopped by performance of any fire protections? 		
34.	<p>Where passive ventilation is utilised:</p> <ul style="list-style-type: none"> Are such systems designed, tested, installed, and maintained by a competent and experienced company in accordance with appropriate testing standards? <p>(Note: NFPA 68 - Passive Explosion Mitigation, NFPA 69 – Standard on Explosion Prevention Systems, BS EN 14797:2006 - Explosion venting devices or FM7730 Examination Standard for Explosion Venting Devices apply)</p>		
35.	<p>Does the exhaust point of any active or passive ventilation systems vent to a safe area in the open, and not located in an area where any exhausted smoke could compromise the air intake of other enclosures or buildings in proximity?</p>		

	Fire Detection, Protection etc.	Y/N	Comments
36.	<ul style="list-style-type: none"> • Is an automatic gas detection system, designed for the detection of lithium-ion battery off gassing, installed within all BESS enclosures? • Are gas detection systems interlocked to the power supply to isolate upon the immediate detection of gases and prior to thermal runaway? • Is the detection system suitably rated for use in potentially explosive atmospheres? • Are the gas detection systems subject to formal testing, servicing/calibration, and maintenance arrangements with a competent and experienced company? <p>(Note: This should be undertaken at least every six months, supplemented by monthly self-inspections to check for damage, faults etc.)</p>		
37.	<ul style="list-style-type: none"> • Does the actuation of any gas detection systems and other BESS alarm automatically de-energise the power supplies and isolate charging equipment? • Are the interlocks tested at least annually and restored following any impairment to the fire protection and alarm systems? 		
38.	<ul style="list-style-type: none"> • Are any gaseous or water based fire suppression systems present or proposed? • If so, has guidance been sought from your BESS insurer and Broker? <p>(Note: Such protections are not recommended due to their potential to increase deflagration/explosion hazards).</p>		
39.	Have the local Fire and Rescue Service inspected the BESS installation, and surrounding area, to evaluate fire risk exposures and consider firefighting tactics?		
40.	<ul style="list-style-type: none"> • Has the following been established: <ul style="list-style-type: none"> ✓ Available firefighting water? ✓ Static pressure flows and residual pressure test results? ✓ Whether additional resources, such as a private hydrant system or water storage tanks are necessary? • Have the fire hydrants in the proximity of the BESS installation been documented in an emergency response plan and/or shown on appropriate drawings? 		

	Maintenance and Self-Inspection	Y/N	Comments
41.	Is all BESS equipment including batteries, cooling, and ventilation, BMS, controller systems and monitoring systems along with associated equipment such inverters, transformers, gas detection systems, lightning protections etc., maintained in accordance with Original Equipment Manufacturer (OEM) and/or system installer guidelines instructions?		
42.	Is maintenance undertaken by competent, experienced, and accredited companies?		
43.	Are maintenance records regularly audited to ensure adequacy of arrangements and compliance with operating procedures, protocols etc?		

44.	<ul style="list-style-type: none"> • Is a programme of monthly self-inspections in place? • Does this include: <ul style="list-style-type: none"> ✓ External inspections of BESS enclosure, including openings vents, footings, security locks, protective seals etc? ✓ External checks of the cabling systems, inverter(s), and transformer(s) for signs of damage, leaks, corrosion, water ingress etc? ✓ Visual inspections of the battery racks and modules for evidence of damage, leaking, corrosion etc? ✓ Visual inspections of electrical wiring, joints, connectors, junction boxes and lightning protection for evidence of wear, fraying, loose connectors? ✓ Visual inspections of the ventilation and cooling systems to ensure correct functionality? ✓ Visual checks of the liquid cooled systems for signs of leaks, loss of pressure and repaired/topped up as necessary? ✓ Visual checks of the air cooled system including filters, airflow, and dust depositing? ✓ Checks of any gas and fire detection systems and automatic fire suppression systems present for signs of damage, leaks, pressure reduction, or other performance issues? ✓ Thermographic cameras checks for overheating or unusual hot spots? ✓ General housekeeping checks including dust, and presence of combustible materials or waste within BESS enclosures or within 10m of the installation? ✓ Alarm or fault lights? 		
45.	Is there a procedure for reporting impairments relating to gas detection and protection systems to your BESS Insurer and Broker?		

	Security	Y/N	Comments
46.	Are the BESS equipment e.g. enclosures, inverters and transformers enclosed within palisade security fencing, and access gates secured to prevent unauthorised persons being in proximity?		
47.	Are outdoor equipment cabinets for inverters etc., securely locked, and any switch/control panels also secured to prevent malicious interference?		
48.	<ul style="list-style-type: none"> Is a detector activated Video Surveillance System (VSS) monitored by an accredited Remote Video Response Centre (RVRC) and achieving level 1 police response installed at the site? If not, is this necessary based on local crime, vandalism, malicious damage incidents? Are the Installer and RVRC members of a UKAS third-party accreditation/approval scheme, such as those provided by the National Security Inspectorate (NSI), or the Security Systems and Alarms Inspection Board (SSAIB)? 		
49.	Have specifications for any proposed detection security systems been submitted to your BESS Insurer and Broker for review?		
50.	<ul style="list-style-type: none"> Does the site benefit from security guarding and/or patrols? If so, are your security guarding company members of the Security Industry Authority and members of a UKAS third-party accreditation scheme, such as those provided by the National Security Inspectorate (NSI), or the Security Systems and Alarms Inspection Board (SSAIB)? 		
51.	<ul style="list-style-type: none"> Have cyber security exposures been reviewed to ensure appropriate protections and procedures are incorporated including data access approval management? 		

52.	Additional comments:		
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