FIRE SAFETY GUIDANCE FOR E-BIKES IN OFFICES

Contents

1 Introduction

The document was primarily developed by The Fire Surgery Ltd, a London based fire engineering company. There were a number of key stakeholders who contributed to the document who are listed at the end of the document.

1.1 Background

E-bikes have risen in popularity over the past decade. In 2023, almost one in 10 bikes sold in the UK were electric - a tenfold increase in less than 10 years. In 2023, around 180,830 e-bikes were sold across the UK (Statista, 2024). E-bikes are likely to encourage commuting when compared with a regular bike.

The data clearly makes the case for planning policy to revisit future provision to reflect use. The popularity of cycling has never been greater and, for context, there are now around 1.26m daily bike trips made in London alone. There is a common goal to increase active travel and cycling, supported through transport planning policies in the National Planning Policy Framework, the London Plan, the Mayor's Transport Strategy and local plans.

For example: In the 2011 London Plan, the recommended standard was one cycle space per 250 sqm of 'gross floorspace'. The 2021 London Plan, revised the standard to the current one cycle space per 75 sqm gross floorspace (for specific areas of inner London).

E-bikes are known to pose a fire hazard and therefore it is essential to address the associated fire and safety risks of e-bike storage associated with commercial offices. Lithium-ion batteries, commonly used in e-bikes, pose unique fire hazards due to their potential to experience thermal runaway, which may result in rapidly growing fires with a higher level of smoke venting when compared the storage of regular bikes. E-bike fires tend to release higher levels of toxic gases in which the species differ from fires involving regular bikes.

The likelihood a battery going into thermal runaway is rare. Good quality, well maintained and undamaged lithium-ion batteries will assist in minimizing a thermal runaway event. The likelihood however increases when aged, poorly manufactured, misused, modified, un-maintained or damaged batteries are used or are paired with incompatible, un-regulated or poor-quality charging equipment.

1.2 Guidance

Fire safety guidance documents such as BS 9999:2017 or Approved Document B consider bike stores as a low-risk spaces. However, these guides do not specifically address the hazards associated with e-bikes.

This guidance provides a framework for mitigating fire hazards associated with e-bike storage in new and existing office buildings, focusing on key safety considerations such as means of escape, automatic fire and smoke detection, notification, fire and smoke containment, automatic suppression, smoke ventilation and overall building fire safety management.

The primary focus is on Electrically Assisted Pedal Cycles (EAPCs) but this guidance could be applicable to other forms of similar transport such as standing e-scooters. This guidance excludes more powerful models with throttle-based control systems that can propel the vehicle without pedalling above 6 km/h, which would require type approval and are typically classed as e-mopeds, as these are intended to be stored in car parks, rather than within standard e-bike facilities.

This document provides both design and management recommendations to mitigate fire hazards linked to the storage, charging, and transit of e-bikes. The aim is to provide safe transit routes within office buildings

for life safety and reduce fire hazards during e-bike storage and charging. The ultimate goal is to improve life safety measures in line with fire safety regulations and best practices and limit the impact on the building fabric.

This guidance can be used to support applications for Building Regulations work or helps building managers fulfil their responsibilities under requirements such as the Regulatory Reform (Fire Safety) Order 2005 in England for occupied buildings. It can be used for discussion with insurers of buildings.

It is important to clarify the limitations of this document. It is not a statutory guidance document and should be used in conjunction with the building's overall fire strategy, assuming the building's design complies with relevant safety standards. The design recommendations outlined here should be implemented by a qualified fire safety professional along with approved installers and other qualified consultants, with the understanding that the information provided is based on current knowledge and may be subject to updates as new research and guidance emerges.

This document does not address fire safety in residential buildings, although the insights provided may be applicable in such contexts. Additionally, it does not define operational procedures for the fire and rescue services (FRS).

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2. Fire Safety Risks of E-Bikes

E-bikes are typically powered by lithium-ion batteries, which provide significant convenience but introduce unique fire safety concerns.

Whilst e-bikes offer a great way to travel, if the batteries become damaged, remain unchecked or begin to fail, they can cause serious fires. When these batteries are charged in communal areas or escape routes, a fire breaking out can block people's ability to escape.

In 2023, London Fire Brigade attended 143 e-bike fires. According to government reports, at least 10 fatalities occurred in residential buildings as a result of fires started in e-bikes powered by lithium-ion batteries in the UK in 2023, with almost 200 fires recorded. As result, government have issued statutory guidelines on lithium-ion battery safety for e-bikes, by the Department for Business and Trade, to assist businesses in producing safe lithium-ion batteries for use in e-bikes (Office for Product Safety and Standards, 2024).

Many of these fires are caused by incompatible chargers, modifications to e-bikes, or faulty or counterfeit products which were purchased online. This includes chargers, lithium batteries and conversion kits for e-bikes.

The primary fire risk associated with lithium-ion batteries is thermal runaway, a chain reaction that can lead to fires. Key contributors to thermal runaway include:

- Overcharging,
- Physical damage,
- Exposure to elevated temperatures,
- E-bike conversions with poor and unauthorised equipment, and/or
- Incorrect / incompatible chargers.

London Fire brigade report that 40% of e-bike fires come from e-bike conversions with poor and unauthorised equipment. Understanding these contributary factors is essential for effective fire risk management.

2.1 Allowing E-Bikes into Office Buildings

Given the fire risks associated, landlords must decide whether to allow the storage of e-bikes within their building. Where the decision is made to permit e-bikes, landlords may want to further consider whether e-bikes can be charged.

A review of the types of bikes requested to be stored and/or charged should be undertaken, following a risk assessment of the storage location by a suitably qualified professional.

Landlords or their agents should reserve the right to prohibit storage of modified e-bikes on their property. The landlord would need to ensure that both leases and property rules include the rights required to enforce the prohibition. In both new and refurbished office buildings, landlords or their agents should consider the provision of safe outdoor cycle storage before internal storage, to reduce the risks to the building.

If no suitable storage areas meeting the design requirements outlined in the guide are available, then the landlord should consider prohibiting the entry of e-bikes to the property on safety grounds.

When e-bikes are stored externally, the proximity and types of material to the building façade must be considered. E-bikes should not be stored in close proximity to the only escape route from a room or storey.

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3. Design Considerations for Fire Safety

In new and refurbished office buildings, it may be possible to provide practical active and passive measures to limit the impact of an e-bike lithium-ion battery fire on the occupants, property and the environment. The following points should be taken into consideration.

- Purpose Group: Cycle storerooms containing e-bikes should be classified as “places of special fire hazard” (as defined by BS 9999:2017, Approved Document B) due to the elevated fire risks posed by e-bikes.
- Risk Profile: The fire growth rate for e-bikes may not be mitigated effectively by sprinklers, and therefore, the risk profile for storerooms containing e-bikes should remain high risk.
- Additional Fire Protection: While enhanced fire and smoke detection systems and increased ceiling heights may allow for a reduction in travel distances and exit widths in other spaces when following the guidance in BS 9999:2017, it is recommended that these measures may not be appropriate for e-bike storerooms, unless explicitly agreed with the Authorities having Jurisdiction.

3.1 Location

Where practicable, e-bike storage should have direct access to the outside to both aid firefighting operations and support means of escape. Locating e-bike storage adjacent to an external wall will also provide a practical location to install smoke ventilation.

Ground floor areas are preferred, however with ground floor areas at a premium in offices, often bike storage is placed in basement areas with end of journey facilities and other back of house store areas. If e-bike storage is only available in basement areas, it should be in close proximity to protected staircases to allow easy means of escape and facilitate firefighting access.

Where access is not possible directly to the outside, e-bike storage should not be directed accessed from a staircase and should be provided with a protected lobby. It is not recommended to provide access to e-bike storage from a staircase that provides sole means of escape from any other part of the building without agreement with the Authorities having Jurisdiction.

E-bikes should not be stored or charged in protected escape routes such as corridors, lobbies and stairs.

3.2 Charging

When planning for the internal storage and charging of removable e-bike batteries, consideration should be given to the provision of dedicated charging lockers that are designed to safely accommodate individual battery units. These lockers should incorporate appropriate fire safety measures, ventilation, and electrical protection to minimize risks associated with overheating, short circuits, or thermal runaway as per the manufacturer's recommendations. Additionally, the room housing the lockers should have security-controlled access to minimise the risk of theft.

Where e-bike charging socket outlets are provided, they should incorporate a timer-controlled arrangement that automatically disconnects power after a maximum of 2 hours to reduce the risk of prolonged charging and potential overheating. The mains power supply to these charging units should be equipped with a remote isolation facility, such as a firefighter's emergency switch, to allow rapid disconnection in the event of an incident. Where practicable, an additional remote cut-off point should be located within the building's security or control room to enable authorized personnel to isolate the system without entering the charging area.

For external e-bike storage and charging, consideration should be given to the installation of dedicated charging stands that allow batteries to be removed and charged separately. These stands should be designed to provide secure bike parking, weather protection for electrical components, and compliance with relevant safety standards. Where possible, the charging infrastructure should include features such as surge protection, tamper-resistant outlets, and clear user instructions to reduce the risk of electrical faults or misuse. Integration with site security measures is also recommended to ensure safe operation in outdoor environments.

3.3 Automatic Fire Detection and Alarm

The room containing e-bikes should be fitted with automatic fire and smoke detection and alarm system integrated into the overall building system. Aspirating smoke detections should be considered to provide enhanced warning. System should be installed to BS 5839-1 (or equivalent).

To support building management and firefighting, a visual alarm device meeting BS EN 54-23 should be considered outside the e-bike storeroom to alert the management and fire and rescue services of a fire in the room. A vision panel in the door to the store is recommended to allow the first responders to observe the incident without having to access the room.

If CCTV is installed within the building, consideration should be given to utilizing cameras in the e-bike store for early heat or smoke detection, such as through thermal imaging or AI-based smoke recognition. This approach can provide a valuable pre-warning to building management before the activation of conventional smoke detection systems.

Where appropriate, dedicated detection technologies capable of identifying battery thermal runaway prior to ignition should be considered. These systems can monitor temperature, gas emissions, or other indicators of battery failure. Integration of such detection with the storeroom's ventilation system is strongly recommended to mitigate the risk of explosion caused by flammable gases released during thermal runaway. This combined strategy enhances early intervention and reduces the likelihood of escalation to a full fire event.

3.4 Means of Escape

Since an e-bike fire can grow and develop very quickly from thermal runaway, two separate exits are recommended from the room housing the e-bikes. This is to avoid single direction escape routes that could be blocked by an e-bike fire. For small rooms, a single exit may suffice if travel distances are sufficiently below standard guidance. Careful management of storage is essential to ensure clear evacuation paths are maintained. Facilities for charging e-bikes should not be placed in a location in which a fire could compromise the ability of occupants to escape from the store, for example close to an exit door.

E-bike storerooms should not form part of an inner room arrangement unless an alternative escape route is provided. This is particularly critical in areas such as changing or shower rooms, where occupants may experience longer pre-evacuation times. Under no circumstances should it be necessary to pass through an e-bike storeroom to reach a place of safety. The design should ensure that escape routes remain direct, unobstructed, and free from additional fire load or ignition sources associated with battery storage.

Exit Route Configuration – In e-bike charging or storage rooms with a single exit door, the route to that door should be as short and direct as possible to minimize evacuation time. Where multiple exit doors are provided, they should lead to separate or protected escape routes to ensure redundancy in case one route becomes compromised. A clear, unobstructed circulation path must be maintained at all times, free from storage, furniture, or other impediments that could hinder safe egress. Designers should also consider visibility, signage, and lighting to support rapid identification of exits during an emergency.

3.5 Fire and Smoke Containment / Compartmentation

E-bike storeroom compartmentation aims to:

- Limit fire and smoke spread, providing time for occupants to evacuate safely.
- Support firefighting activities by providing operational time for fire and rescue services.
- Enhance the overall fire strategy by providing adequate fire resistance to e-bike storerooms.

Given the limited data on the combustion characteristics and fire dynamics of e-bike batteries, a conservative approach to compartmentation is strongly recommended. This should include the provision of fire-resisting construction around e-bike storage areas to contain potential incidents and prevent fire spread to adjacent spaces. Designers should consider appropriate fire resistance ratings, smoke control measures, and integration with the building's overall fire strategy to mitigate uncertainty and ensure occupant safety.

As a minimum a 60-minute (R)EI fire resistance is suggested, although a performance-based approach may be used for specific projects, subject to agreement with the Authorities having Jurisdiction

Fire-resistant construction should be non-combustible or prevent combustible elements from becoming involved in the fire. Robust construction such as masonry or blockwork is preferable.

Further Considerations:

- Avoid installing lockers, drying areas, or additional items in e-bike stores to minimize fire load.
- Where designers are planning large bike stores (typically in excess of 50 e-bikes), the design should consider sub-division, with a minimum of 60 minute fire resistant construction, to reduce the maximum fire size as well as reduce the risks of excess fire and smoke spread. Means of escape should be provided direct from each sub-divided area, as well as into an adjoining bike store.

3.6 Automatic Suppression Systems

At present, there is little guidance on the type of effective automatic suppression systems in relation to e-bikes fires. It is known that once thermal runaway occurs, lithium-ion batteries are difficult to supress and extinguish. However, if automatic suppression is used, it may limit fire spread within in the storeroom and could prevent other e-bikes from becoming involved.

Fire suppression systems should be designed to deliver sufficient discharge to cool lithium-ion batteries effectively and prevent the risk of reignition, which can occur due to residual heat or internal cell damage. The suppression system should maintain cooling until firefighters can safely intervene and remove compromised batteries. Consideration should be given to the duration and intensity of discharge, system reliability under high thermal load, and integration with early detection and ventilation controls to manage flammable gases released during thermal runaway. Where possible, suppression strategies should align with emerging standards and manufacturer guidance for battery-specific hazards.

The use of gas suppression systems, foam-enhanced sprinklers, or water mist systems for lithium-ion battery fires is currently not recommended due to limited evidence of their effectiveness and potential safety concerns. As e-bike technology and associated fire risks evolve, it is anticipated that fire suppression

standards will adapt accordingly. In the future, manufacturer-tested and certified suppression solutions specifically designed for lithium-ion battery hazards may become viable options. Until such systems are proven and standardized, reliance should remain on sprinkler protection (where possible) as well as early detection and compartmentation strategies.

Therefore, where possible, sprinkler systems are recommended for e-bike storerooms. A suitably designed automatic suppression system to BS EN 12845:2015 should be included.

3.7 First aid fire fighting

Handheld fire extinguishers are not a statutory requirement; however, they are generally provided following a fire risk assessment and are recommended in most recognized guidance documents. These extinguishers are intended for use by trained personnel only and should not be relied upon by the general public.

Portable fire extinguishers can be effective for first-aid firefighting on small, contained fires. However, due to the rapid escalation and severity of lithium-ion battery fires in e-bikes, it is strongly advised that personnel do not attempt to extinguish such fires. Instead, they should be trained to evacuate the area immediately and contact the fire and rescue services without delay.

Building management teams should also consider the risk of thermal burns associated with battery failures. The provision of locally sited burns kits, alongside clear emergency procedures, can provide valuable first-aid capability until professional medical assistance is available.

3.8 Ventilation

Ventilation is critical for mitigating hazards associated with toxic gas release and potential explosions during e-bike battery fires. Ideally, e-bike storage rooms should be positioned adjacent to external walls with direct openings to the outside, such as doors, windows, or dedicated vents.

Where direct external ventilation is not feasible, an appropriately sized ducted ventilation system should be installed and integrated with the fire detection system to enable automatic activation during an incident. The design of such a system should follow recognized fire engineering principles and methodologies, such as those outlined in BS 7974, ensuring that airflow rates, smoke clearance, and gas dilution are sufficient to maintain tenable conditions and reduce explosion risk. Designers should also consider redundancy, power supply resilience, and maintenance access to ensure reliable performance during emergencies.

For mechanically ventilated basements, current guidance such as BS 9999:2017 is generally considered sufficient, and no additional ventilation measures are typically required. However, designers should ensure that airflow rates and extraction points are adequate to manage smoke and flammable gases, and that systems are maintained to prevent failure during emergencies

For naturally ventilated basements, designers should undertake a detailed assessment of the ventilation system's performance based on the maximum credible fire scenario. This assessment should account for the possibility that a fire could spread to multiple e-bikes, resulting in a fire size significantly greater than the original design assumptions. The evaluation should consider airflow rates, smoke clearance times, and the ability to dilute or remove hazardous gases generated during thermal runaway events. Where deficiencies are identified, additional ventilation measures or alternative mitigation strategies should be implemented to maintain life safety and compliance with relevant standards.

3.9 Drainage

Suitable drainage should be provided to manage water run-off from sprinkler activation or firefighting operations, with particular attention to the potential presence of contaminants such as lithium salts, heavy metals, and electrolyte residues from damaged batteries. Drainage systems should be designed to prevent uncontrolled discharge into the environment and, where feasible, incorporate containment or treatment measures to comply with environmental regulations. Early consideration of these requirements during design can help mitigate pollution risks and support safe clean-up following an incident.

3.10 Firefighting

Firefighting operations will ultimately depend on dynamic risk assessments carried out by responding fire and rescue service personnel. To assist them and improve operational safety:

- Site Familiarization: Arrange for local fire and rescue services to visit the premises and familiarize themselves with the building layout, particularly the e-bike storage areas and associated hazards.
- Block Plans: Ensure that block plans are accurate and up to date, clearly indicating the location of e-bike storage rooms, master electrical isolation switches, ventilation controls, and other critical information. It is recommended that these are stored in a Secure Information Box, meeting the recommendations of the local Fire and Rescue Service and / or national guidance.
- Signage: Install clear, durable signage at strategic points to identify e-bike storage areas and indicate the nearest safe exit routes meeting the guidance given in BS 5499 (or equivalent).

Additionally, a master electrical isolation switch should be provided and prominently signed at key locations, such as the entrance to the e-bike storeroom and adjacent to the main fire detection and alarm panels. This measure enables rapid power shutdown during an emergency, reducing the risk of electrical hazards and aiding firefighting efforts.

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4. Building Management Considerations

Fire safety in buildings is a balance between the technical systems within the building and how the building is then used and managed. It is not possible to rely solely on the technical provisions in the building, and an active role on the part of the landlords and users is essential.

There are now moves by the planning teams within the City of London to open up private cycle spaces to members of the public, which will cause a number of challenges for the property management teams. This space would be offered under a management regime and possible subscription, but as the user has no real legal ties with the building, enforcement of policy will be a challenge.

As with all buildings, there will be standard fire safety management requirements for the day-to-day operation of the building.

Effective management of fire safety can contribute to the protection of the building occupants in many ways:

- By working to prevent fires occurring in the first place,
- By monitoring the fire risk on an on-going basis and taking appropriate action to eliminate or reduce those risks,
- By ensuring that all the fire safety measures in the building are kept in working order and that the means of escape are always available,

- By providing adequate means for the fire and rescue service to effectively gain access to the building should a fire occur.

Specific points for the owners and their agents to consider to mitigate the risk associated with e-bike fires includes:

- Do e-bikes need to be permitted in the building – is there adequate storage outside?
- Develop a clear management policy for the use of e-bikes and educate building users of their responsibilities.
- Consider whether leases have been agreed that allow for the controls to be put into place to manage the control of access to a property.
- Understand the design of the storage areas by reviewing the O&M information.
- Review guides and rules for the management of e-bikes been completed on an annual basis.
- Ensure that a risk assessment has been carried out on the building for the storage of e-bikes and that all actions been completed.
- Assess whether e-bikes have been sourced from reputable suppliers and how this has been evidenced.
- Where charging units are not supplied by the landlord,
    - Inspect for the correct use of chargers and consider installing specific charging stations.
    - Portable appliance testing on e-bikes brought in buildings should be undertaken.
- Where the landlord has supplied chargers, ensure that all supplier maintenance is up to date.
- E-bikes should not be allowed to overcharge and this should be monitored.
- Maintain the e-bike storeroom to remove unnecessary combustibles and storage provisions.
- Include e-bike storerooms in the annual fire risk assessment.
- If fixed CCTV is not available, consider using thermographic camera equipment to that can detect changes in temperature of e-bike batteries

A further mitigating measure is to encourage e-bike users to test battery viability prior to charging. Certification of batteries alone is not a solution, as it only considers the condition of a battery when it leaves the factory. Factors such as ageing, charging routines, physical impacts, and exposure to water can all affect battery safety over time, meaning many batteries should be retired before they cease functioning.

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5. Contributors

The concept for this guide was developed by The Fire Surgery, a firm specializing in fire strategy development for office buildings. Input was gathered from key stakeholders, whose contributions were instrumental in shaping the guide. A list of these contributors is provided below.

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Personal Light Electric Vehicle (PLEV) Battery Safety Research, OPSS, Jan 2025

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