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Guidance

Statutory guidelines on lithium-ion battery safety for e-bikes

Guidance for businesses.

From: **Office for Product Safety and Standards (/government/organisations/office-for-product-safety-and-standards)**

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Applies to England, Scotland and Wales

Contents

About these guidelines

These statutory guidelines are made by the Department for Business and Trade to assist businesses in producing safe lithium-ion batteries for use in e-bikes.

Lithium-ion batteries used in e-bikes can pose a serious fire risk through a process known as thermal runaway. At least 10 fatalities occurred in fires started in e-bikes or e-scooters powered by lithium-ion batteries in the UK in 2023, with almost 200 fires recorded.

These statutory guidelines set out the safety mechanisms that lithium-ion batteries for e-bikes must contain to address the risk of thermal runaway. They must be taken into account by producers of lithium-ion batteries when assessing whether their battery meets legal safety requirements and by distributors in ensuring they do not supply products that they know or ought to know to be dangerous, in line with their legal requirements under the General Product Safety Regulations 2005 (https://www.legislation.gov.uk/uksi/2005/1803/contents) (GPSR) as it applies in Great Britain (GB). However, adherence to these guidelines is strongly recommended for businesses placing such products anywhere on the UK market.

The GPSR applies to all lithium-ion batteries for e-bikes, including those sold online or those sold for use with or as part of a conversion kit. It is an offence to place a lithium-ion battery on the market if it is not a safe product.

The Office for Product Safety and Standards (OPSS), as the UK's national product regulator, and Local Authority Trading Standards, have powers to enforce the GPSR and there are sanctions, including criminal sanctions, for those that do not comply.

1) Who is this for

1.1 These statutory guidelines are for businesses who produce, import or distribute lithium-ion batteries for use with e-bikes, including converted e-bikes that are made available on the GB market.

1.2 These guidelines are made by the Secretary of State for Business and Trade under regulation 6(3)(c) of the GPSR. They must be taken into account by businesses when assessing whether a lithium-ion battery meets the general safety requirement under regulation 5 of the GPSR.

1.3 'Lithium-ion battery' should be taken to mean lithium-ion battery packs supplied for use with e-bikes or e-bike conversion kits, incorporating individual cells and protective measures that are intended to be charged

either with the e-bike or separately. Other batteries, for example lithium-ion batteries used in laptop computers, are not in scope of these guidelines.

1.4 The guidelines focus on key areas of concern. The contents of these guidelines are not an exhaustive list of the actions businesses must take to meet the requirements of the GPSR when producing, importing or distributing products.

1.5 These guidelines will be used by regulators to help determine whether lithium-ion batteries meet the legal safety requirements under GPSR.

2) Products in scope of these guidelines

2.1 E-bikes are typically powered by lithium-ion batteries. E-bikes can be sold as complete products (including a compatible battery pack and battery charger) and replacement batteries can be purchased for them. Standard pedal bikes can be converted to an e-bike, using a conversion kit comprising various parts that typically include some or all of: a motor, motor controller, battery, battery charger, handlebar controls, sensors and wiring to connect the components.

2.2 Lithium-ion batteries produced to supply power to e-bikes (including e-bike conversions) are in scope of the GPSR and must meet the general safety requirement of these regulations. The key requirement is that businesses must ensure that products placed on the market are safe.

3) Battery safety and thermal runaway

3.1 Poorly designed, poorly manufactured or incompatible battery components, and the use of batteries outside of their safe design parameters, present a risk of thermal runaway.

3.2 Thermal runaway happens when the temperature of individual battery cells contained within a battery reaches a critical point at which exothermic reactions occur. Exothermic reactions are chemical reactions that generate heat faster than it can be dissipated within the battery cell. This creates gas within the cell, causing the cell casing to rupture, which can result in the release of flammable and potentially toxic gases that could ignite, causing a fire and/or explosion. This has the potential to endanger life and destroy property.

3.3 Battery cells in thermal runaway are likely to increase the temperature of adjacent cells within the battery pack, resulting in additional cells entering thermal runaway and a cascading effect throughout the battery. This can result in gases igniting, causing a fire and/or explosion that can develop

rapidly and become extremely volatile, with the potential to spread to its surrounding environment.

4) Regulatory position on safe products under GPSR

Battery protective system

4.1 To be considered a safe product under GPSR, a lithium-ion battery intended for use with e-bikes or e-bike conversion kits must include safety mechanism(s) (such as a battery management system, and/or other equivalent safety features) whose functionality is capable of preventing thermal runaway from occurring during normal operation and conditions of reasonably foreseeable misuse. This includes when the e-bike is in use and the battery is discharging power, and when the battery is being charged.

4.2 A core safety mechanism could be the presence of an effective battery management system, which is a local energy management system for the battery pack/system. Its function includes protecting the battery system from damage, which in turn prevents the battery pack from entering thermal runaway. Where a battery management system is not present, a battery should have equivalent protective safety features that perform a comparable function.

4.3 An effective battery protection system must be capable of detecting the voltage of individual cells and the battery pack current, and the temperature of the cells during charging and discharging of the battery pack. It must be able to act to prevent charging or discharging from causing over- or under-voltage of any cell, over-current of the pack, and over- or under-temperature of the cells, to prevent the battery from entering into thermal runaway where operating outside of normal and manufacturer-stated parameters.

4.4 The battery protection system must also be capable of preventing the battery cells from entering thermal runaway as a result of the charging of the battery pack by an incompatible battery charger.

Battery design and physical construction

4.5 The design and construction of a lithium-ion battery should sufficiently resist damage from external sources. This includes high and low temperatures (including sunlight), liquids (including water ingress), and reasonably foreseeable impact and vibration from normal wear and tear.

Information requirements

4.6 Battery packs should be supplied with relevant information to enable businesses and users to be able to assess the compatibility of the battery for its intended use. Particularly, information should be provided on sourcing compatible chargers.

4.7 Battery packs should be provided with sufficient information and instruction to inform users how to charge the product safely and to establish safe charging practices.

5) Producer responsibilities

5.1 The GPSR sets out the obligations of 'producers'. This includes businesses who manufacture and import products. The definition of a 'producer' is set out in Regulation 2 of the GPSR.

5.2 Before placing a product on the market, producers must ensure that it is safe. This means, under normal or reasonably foreseeable conditions of use, the product does not present any risk or presents only the minimum risk compatible with the product's use, and which is considered acceptable and consistent with a high level of protection of health and safety.

5.3 To achieve this, a producer must ensure that lithium-ion batteries produced for e-bikes possess adequate and effective safety protections to mitigate the risk of thermal runaway. They must also ensure that the battery is constructed in such a way that it is protected from reasonable external damage, and is supplied with relevant product information.

5.4 Producers must also adopt measures to enable them to be informed of risks the product might present, such as:

a. sample test products they produce

b. investigate and, if necessary, keep a register of complaints concerning the safety of the product

c. keep distributors informed of the results of such monitoring where a product presents a risk or may present a risk

5.5 Where the producer knows that a product they have placed on the market or supplied poses risks to the consumer that are incompatible with the general safety requirement, they must notify OPSS or their Local Authority Trading Standards in writing about the risks and the action taken to prevent risk to the consumer.

5.6 OPSS has published guidance on completing notifications to enforcement authorities regarding product safety risks (https://www.gov.uk/government/publications/business-notifications-of-unsafe-and-noncompliant-products).

5.7 Additionally, the British Standards Institution has published a Code of Practice on Corrective Actions and Recalls (https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/pas-7100-product-recall-and-other-corrective-actions-code-of-practice/) that provides guidance on fulfilling these obligations.

6) Product safety assessment: demonstrating protections against thermal runaway (Producers)

6.1 Producers should consider the following steps:

- Demonstrating the battery meets the safety requirements to protect against thermal runaway, or the causes of thermal runaway, as set out in relevant standards, and making use of the latest technologies.
- Compiling technical documentation that demonstrates the performance of safety mechanisms present in a lithium-ion battery, and how they are designed to protect against thermal runaway or the causes of thermal runaway.
- Holding copies of product test reports that demonstrate the performance of safety mechanisms present in a lithium-ion battery, designed to protect against thermal runaway or the causes of thermal runaway as set out in section 4, and providing this documentation to an enforcement authority upon request.

6.2 However, there may be other ways for producers to carry out a product safety assessment that demonstrates that a lithium-ion battery in scope of these guidelines is a safe product.

6.3 These guidelines do not specify the routes producers must take. Businesses are responsible for ensuring they comply with the law and are best placed to assess this when considering their specific products, procedures and operations.

7) Distributor responsibilities

7.1 The GPSR places obligations on distributors of products. The definition of a distributor is set out in regulation 2 of the GPSR.

7.2 Distributors are required to act with due care to help ensure only safe products are supplied on the market. Distributors must not supply products that they know or ought to know to be dangerous. For example, if a product has been subject to a recall, or if they are notified of a safety concern by a producer, distributors must not supply any such products they may still have in stock.

7.3 Distributors must also cooperate with enforcement authorities at their request. This includes providing information they hold relating to risks posed by the product and enabling the product's identity and origin to be traced. Distributors must take appropriate action to remove the risk from consumers such as withdrawing dangerous products from the market and participating in any corrective action or recall activities.

7.4 Where the distributor knows that a product they have placed on the market or supplied poses risks to the consumer that are incompatible with the general safety requirement in the GPSR, they must notify the producer and the relevant authority in writing about the risks and the action being taken to prevent risks to the consumer.

7.5 OPSS has published guidance on completing notifications to enforcement authorities regarding product safety risks (https://www.gov.uk/government/publications/business-notifications-of-unsafe-and-noncompliant-products).

8) Product safety assessment: demonstrating protections against thermal runaway (Distributors)

8.1 These guidelines do not specify the routes distributors must take. Businesses are responsible for ensuring they comply with the law, and are best placed to assess this when considering the products they supply, their procedures and operations.

8.2 However, distributors should consider the following steps:

- Obtaining information from producers and sellers confirming that a battery meets the requirements to protect against thermal runaway or the causes of thermal runaway, which are set out in relevant standards or using the latest technologies.
- Ensuring that products they distribute possess the relevant information in instructions and/or markings, as set out in section 4.7.
- Putting in place any assurance procedures they deem necessary to confirm the substance and/or accuracy of technical information supplied by producers.

8.3 Distributors should assure themselves, before making a lithium-ion battery available on the market, that the product is compliant and meets the requirements of the GPSR.

9) Legal requirements

9.1 The GPSR provides the basis for ensuring the safety of consumer products by setting out safety requirements and obligations that businesses must meet.

9.2 The legal basis for issuing these guidelines is regulation 6(3)(c) of the GPSR as it applies in GB, which makes provision for the Secretary of State to set guidelines on assessing a specific product's safety for the purposes of GPSR.

9.3 These guidelines must be taken into account by businesses in assessing whether lithium-ion batteries for e-bikes and e-bike conversion kits meet the requirements of GPSR as they apply in GB.

9.4 Where businesses involved in the production or distribution of products in scope of these guidelines do not take account of them when placing such products on the market, they will be in breach of their responsibilities under the GPSR.

9.5 In addition, following these guidelines is strongly recommended for businesses producing or distributing such products placed on the Northern Ireland market.

10) Non-compliance with the regulatory requirements

10.1 OPSS and Local Authorities have powers to enforce the requirements in the GPSR, including the requirement for products to be safe.

10.2 If investigations identify non-compliance with the GPSR, authorities will be able to take action against producers and distributors, which could require businesses to recall products from consumers, suspend supply of products, warn customers about risks, or withdraw products from sale. Additionally, where non-compliant products are identified at the border, they may be prevented from entry.

10.3 Producers and distributors are required to cooperate with enforcement authority requests in relation to action taken to mitigate risks posed to consumers by a product, including providing information and documentation upon request.

10.4 Where businesses breach certain obligations under GPSR, and it is appropriate and proportionate to the circumstances of the breach, enforcement authorities may initiate prosecution proceedings and, if found guilty of an offence, the person or persons responsible could face an imprisonment sentence and/or financial penalty.

11) Further information

Voluntary standards can often help manufacturers to meet legal requirements. To find out more about the standards that apply to e-bikes and their batteries, please refer to:

- BS EN 50604-1:2016+A1:2021 – Secondary lithium batteries for light EV (electric vehicle) applications – Part 1: General safety requirements and test methods
- BS EN 15194:2017+A1:2023 for Electrically power assisted cycles – Designated to provide a presumption of conformity under the Supply of Machinery (Safety) Regulations 2008.

For more information on bringing safe products to market and undertaking product recalls and other corrective actions, please refer to the free PAS documents on the BSI website:

- PAS 7050:2022 Bringing Safe Products to the Market (https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/pas-7050-bringing-safe-products-to-the-market-code-of-practice/)
- PAS 7100:2022 Product Recall and Corrective Actions (https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/pas-7100-product-recall-and-other-corrective-actions-code-of-practice/)

For further information on the General Product Safety Regulations 2005, as they apply in Great Britain, please refer to:

- General Product Safety Regulations 2005 (https://www.legislation.gov.uk/uksi/2005/1803/contents) – legislation.gov.uk
- Guidance on the General Product Safety Regulations 2005 (https://www.gov.uk/government/publications/general-product-safety-regulations-2005/general-product-safety-regulations-2005-great-britain)

For further information on completing statutory notifications where products have been identified as unsafe or non-compliant, please refer to:

- Business notifications of unsafe and noncompliant products (https://www.gov.uk/government/publications/business-notifications-of-unsafe-and-noncompliant-products)

For information about OPSS' approach to delivering regulation, please refer to:

- OPSS Enforcement Policy (https://www.gov.uk/government/publications/safety-and-standards-enforcement-enforcement-policy/opss-enforcement-policy)

Enquiries in relation to this guidance should be directed to: opss.enquiries@businessandtrade.gov.uk.

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