BBC Studioworks

Safe Use, Storage, Transportation and Disposal of Lithium-ion Batteries

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1. Introduction

Lithium-ion (Li-ion) rechargeable batteries are now commonplace, used in everyday items within the home as well as workplace. Examples include laptops, mobile phones, watches and portable power packs. This assessment focuses on the lithium-ion batteries used as part of studio and facility operations including, but not limited to, electric road vehicles (EVs), rechargeable camera batteries and the wireless intercom systems used for production talk-back i.e. wireless beltpacks and the more traditional 'walkie-talkies'. Such equipment can be used in sizable quantities, which due to production schedules and operational requirements, are often charged unattended on Studioworks sites. This document assesses the risk for the equipment, where it is located, and the arrangements and controls required for their safe use, storage, transportation and disposal.

2. Assessing the Risk

Monitoring

To reduce the risk of a Lithium-ion battery fire, batteries should be regularly monitored. Warning signs to look for include:

- Appearance – does the battery or equipment look damaged? Is the casing cracked? Is there discolouration, bulging or leaking of liquid?
- Heat – is the battery/equipment too hot to touch?
- Noise – is the battery making hissing or cracking sounds?
- Smell – is there a smell coming from the battery?
- Performance – does the battery no longer fully charge or take longer than usual to charge?
- Smoke – if a battery is smoking then a fire has already started and emergency procedures (stated below) should be enacted

Electrical Testing

All equipment should be regularly PAT tested as per the Studioworks Electrical Testing policy and procedure.

Lithium-ion Fires

Once a lithium-ion fire has started it is very hard to stop as it triggers a phenomenon known as 'thermal runaway'. The internal temperature of the battery increases rapidly, leading to a self-reinforcing cycle of heat generation between the individual cells of the battery. Any batteries nearby e.g. in the same charging station will also catch fire due to the intense heat produced, creating further thermal runway. Once thermal runway begins, as well as intense heat, flammable, toxic gasses are produced creating pressure that builds up within the battery casing that can cause the battery to explode. Fire can then also spread to nearby combustible materials. This chemical reaction also produces oxygen which acts as an oxidiser, sustaining the fire and allowing it to spread further making the fire very difficult to extinguish.

Emergency Procedures: Tackling a lithium-ion fire

If a lithium-fire is in its early stages of a fire, i.e. smoking, a trained Fire Warden may attempt to extinguish the fire using a fire extinguisher specifically designed for use on lithium-ion fires and remove any nearby batteries and combustible materials, where it is safe to do so. However, this situation should still be treated as any other fire and a call point activated as soon as possible to alert others; to gain assistance in calling the emergency services and begin an evacuation of the building for all occupants should the fire take hold. If one lithium-ion fire extinguisher does not successfully put out the fire, then the area and building should be evacuated immediately. Any doors/fire doors to the storage area should be closed (where it is safe to do so) to help contain the fire.

Once a lithium-ion fire has taken hold and flames are observed it must not be attempted to be extinguished as there is a high risk of injury to anyone in the vicinity. Not only is there a risk of explosion, but the release of toxic gasses is hazardous to human health and can quickly incapacitate anyone nearby. Where a fire is witnessed to have taken hold, the area must be evacuated immediately, alerting others by shouting 'fire' and activating the nearest call point as they leave. Any fire doors should be closed along the evacuation route as the building is vacated.

2.1 Equipment selection and Use

- Only equipment, batteries and charging accessories from an approved manufacturer/supplier should be used. Non-compliant charging equipment can cause overheating, leakage or explosion.
- Only batteries that are designed to stop charging once they reach 100% should be used
- Pre-user checks should be carried out to ensure there are no signs of damage or wear and tear to the charging equipment before each charge

2.2 Charging and Storage

- Only compliant charging equipment approved by the manufacturer to be used
- All equipment to be carefully seated/attached into the charging station slot/cable with a competent person, dedicated to the role, checking all equipment is not damaged and correctly connected to the charging station/cable at the end of each day. If equipment is not correctly seated within charging stations the contacts can become worn which increases the risk of a fire.
- Any load should be detached from the batteries when charging or being stored
- Charging stations/areas should be clearly defined within each building and located on or within non-combustible surfaces. Defined areas should have appropriate fire-rated enclosures, fire compartmented rooms or areas. Charging stations should be placed on a fire-resistant surface such as a metal cabinet, shelf or plate.
- Where equipment is not to be used for a period of time, it should be removed from the charging station/cable and stored in a suitable location. For long term storage it is advisable to store the batteries at between 40 and 60% charge where they are at their most stable (or as manufacturer guidance states). Any batteries stored long term should be periodically assessed, every 3-6 months, given a visual inspection and recharged to 40-60% where necessary.
- Moisture can cause corrosion so charging stations/areas should be well ventilated and kept in a cool, dry environment. The temperature of the space should also be kept between 15-25°C to prevent overheating.
- When batteries are charged, especially in large quantities and are unattended, ensure suitable smoke detection that is linked to the building's fire alarm system to provide early warning of a fire. (Lithium-ion batteries often start to produce smoke before a fire takes hold.)
- Provide a fire extinguisher designed for lithium-ion fires in the vicinity of any charging stations/areas

2.3 Maintenance of Batteries and Charging Equipment

Lithium-ion batteries deteriorate over their lifespan and manufacturers guidance should be consulted for individual types of batteries. However, a number of factors can affect their lifespan:

- Charging batteries regularly to 100%. Lithium-ion batteries work most efficiently when charged to around 80% as it reduces the stress load.
- Incorrect seating of the batteries in charging stations can result in the contacts becoming worn
- Charging batteries whilst connected to a load
- Long term storage of batteries outside of their optimum charge (40-60%)
- Excessive temperatures and moisture

All equipment must be PAT tested and have regular visual inspections carried out. Battery contacts should be inspected for dirt, grime and dust and kept clean with a microfibre or lint free cloth. Any associated equipment such as charging stations and leads should also be regularly inspected to check for obvious wear, tear and damage. Any defective equipment should be taken out of service immediately, put in suitable containment such as a metal box, clearly marked as defective and given to the engineering department for assessment.

2.4 Transportation

- Before transporting, batteries should be visually inspected for any signs of damage
- Batteries should be packaged suitably to prevent short circuits i.e. individual packaging, insulating terminals and in suitable containment that is fire-resistant, leak proof and protects them from physical damage
- Transport at a state of charge that reduces the likelihood of thermal runaway; at a charge not exceeding 30% or as per manufacturer guidelines
- Ensure batteries are not exposed to temperatures outside of their recommended range during transportation
- Ensure all regulations governing the transportation of batteries are met, whether sending within the UK or abroad

2.5 Disposal

All lithium-ion batteries should be safely disposed of in line with manufacturer's guidance and regulations, in specific battery recycling waste streams. Batteries should never be disposed of in general waste as they may start a fire and will be surrounded by combustible materials. Many components of batteries are now recyclable, so appropriate disposal is also a sustainable solution.

Special consideration should be given to any damaged batteries which should be stored securely when disposing of e.g. battery contacts are taped to insulate and the battery is put in an insulated bag or metal box to reduce the risk of fire.

2.6 Electric Vehicles (Road Use)

Studioworks utilises electric vehicles (EVs) to carry out its logistics operations on the public highway. Electric vehicle fires are relatively rare. However, they are incredibly difficult to extinguish and have the potential to cause severe injury to anyone nearby and cause immense damage to property. An electric vehicle fire should only be dealt with by the Emergency Services.

In order to reduce the risk of fire:

- Maintenance and servicing to be carried out at regular intervals by an approved service centre, in line with manufacturers guidance
- On-site charging points should be located externally and away from buildings wherever possible
- Landlord installed charging points should meet all regulations and certified for use with electric vehicles
- Only approved charging points should be used when charging off-site
- Only certificated charging equipment should be used
- Charging points and charging cables should be inspected for damage, wear and tear and ensure they are clean and dry before each use
- All drivers to be aware of electric vehicle manufacturer guidelines for charging practices
- Charging sessions should be monitored and once charged, disconnected as soon as possible
- Emergency procedures in place in event of a fire on site

2.7 Electric bikes (e-bikes) and Electric scooters (e-scooters)

Electric bikes and scooters have become an increasingly popular mode of transport due to their convenience, cost and eco-friendless. However, they present certain fire risks associated with their lithium-ion batteries, especially when being charged. As an employer has limited control over how its workforce, clients, tenants and visitors manage and maintain such vehicles, Studioworks policy is that e-bikes, e-scooters and any other similar vehicles are strictly prohibited from being brought inside its buildings. Any such vehicles must be left externally at designated fire-safe areas such as external bike parking storage facilities. In addition, individual Landlords may have further restrictions that must be adhered to.

Please note mobility scooters are permitted inside Studioworks buildings. Please contact the local Studioworks Facilities Manager to confirm the locations at which they can be charged to ensure the charging point/infrastructure is compliant.