

Battery Powered Forklift Trucks – Property

Forklift trucks are used to move materials and occasionally provide access to work areas.

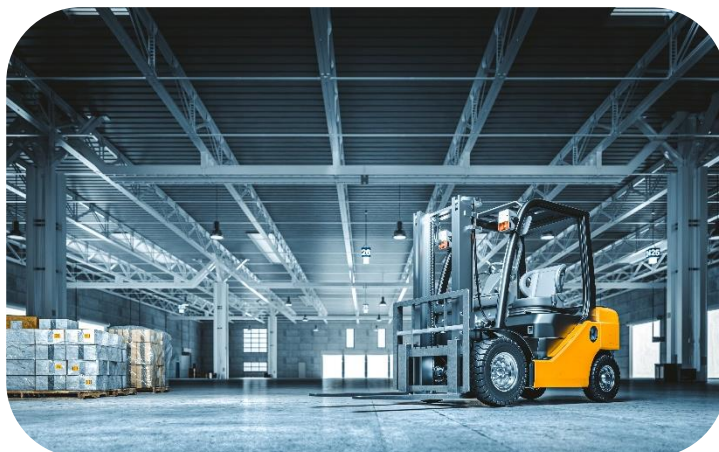
This Loss Prevention Standard discusses the risks associated with lead-acid battery powered forklift trucks, and provides risk management guidance to help prevent fires and other property loss events.

Battery Powered Forklift Trucks – Property

Introduction

Forklift trucks are used by businesses and organisations to move goods and materials both within and outside of buildings. This ranges from a single vehicle within a small storeroom to large fleets used in distribution centres or large logistics and warehousing operations.

Forklift trucks for use within buildings are commonly lead-acid battery powered, however lithium-ion battery, liquified petroleum gas (LPG) powered vehicles, hydrogen and diesel powered trucks are also available but not specifically discussed in this document.



Refer to Aviva Loss Prevention Standard **Lithium-ion Batteries – Storage and Transit** for guidance on the use of lithium-ion battery powered forklift equipment, and **Forklift Trucks – 12 Top Tips** for a summary of best practice risk management guidance, including guidance on diesel and LPG powered vehicles.

Whilst a common and essential item of equipment, battery powered forklift trucks present a number of risk exposures that require careful management. This Loss Prevention Standard provides an overview of the common risks and practical guidance on reducing the potential for loss events such as fire, impact, etc.

Note: This document relates to the use of battery powered forklift trucks and is focussed on property loss prevention and related risk management guidance. It is not intended to address liability exposures. The presumption is that all regulatory requirements, such as fire risk assessments and compliance with local building regulations, codes, or standards, have or will be met. For the purposes of this document, the terms forklift trucks includes removable and interchangeable battery packs, as typically used in warehouse environments where multiple forklift trucks are utilised. Whilst not specifically aimed at other battery powered plant or equipment, e.g. powered pallet trucks, floor scrubbers, etc., the guidance may be applicable or adaptable in some circumstances.

Understanding the Risks

Lead-acid batteries are the most common large-capacity rechargeable battery type in commercial use, and are commonly used for lift trucks and other lifting equipment such as mobile elevated work platforms, powered pallet trucks, etc.

Lead-acid batteries typically consist of two metal plates, one pure lead and one coated in lead oxide. They are immersed into an electrolyte solution within a plastic battery case, comprising between 35% to 50% sulfuric acid and 50% to 65% distilled water, commonly referred to as battery acid. Other components include insulated separators, which are situated between the plates and help prevent short circuiting; terminals for connecting the vehicle to the battery and vents, which allow gases built up during charging, including hydrogen and oxygen, to escape safely.

When the battery is charged, a chemical reaction occurs which releases electrons, which are stored in the battery's plates and can be used to power electrical devices when the battery is connected in a circuit.

Other lead-acid battery types include:

- **Gel Cell.** The electrolyte is absorbed into a silica-based gel within the battery case.
- **Absorbent Glass Mat.** The electrolyte is absorbed into a fibreglass mat within the battery case.

Whilst uncommon, the consequences of loss events involving forklift trucks can be very significant. Risk exposures include, but are not limited to:

- **Overcharging.** Overcharging can lead to batteries overheating, release of combustible gases and ignition.
- **Hydrogen Gas.** The charging process produces a small amount of hydrogen gas, which is generally safely dissipated in the charging location via manual or mechanised ventilation. Overcharging can increase the rate of gas production.
- **Ventilation.** Inadequate or faulty ventilation can result in flammable gas accumulation in and around the charging area.
- **Sparking.** Charging leads and terminals can become damaged, cable wiring can become exposed and make contact with metal components with resultant sparking which may serve as an ignition source.
- **Electrical Fault.** Charging equipment can be damaged or become faulty, leading to overheating and ignition.

The potential for fire propagation can be aided by:

- **Fire Load.** This is the amount of combustible material that could support fire growth, and includes the vehicle as well as nearby combustible materials, e.g., packaging, other goods/stock, pallets, etc., Individual buildings may also feature a high proportion of combustible construction which could also support fire growth.
- **Fire Penetrations.** Air bricks, ventilation, extraction, electrical systems, etc., can bypass a buildings fire barriers. Inadequate or defective fire stopping can also allow fire to spread into and through the property.
- **Fire Detection and protection.** Lack of, or inappropriately/incorrectly specified fire detection and protection and interlocks to charging power supplies can result in uncontrolled fire development.

In addition, forklift truck movements can impact buildings, equipment, stock, storage racking and persons.

Risk Assessment

Risk Assessment

Regulatory risk assessments should be conducted in respect of forklift use and charging where necessary and identified risk control measures implemented. In the United Kingdom this is typically addressed within the various home nation fire risk assessment based legislation, and the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR), if the vehicles are operating in any areas where explosive atmospheres may be present. Such assessments should be completed by a competent person and any corrective actions monitored until completion.

Note: Risk assessments are deemed the minimum requirement, and following the recommendations in this document can help further reduce property risk exposures.

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

Material Damage Risk Assessment

Before initiating risk management controls or installing any additional fire detection and protection systems, an assessment of the anticipated/possible financial losses, for both the material damage and business interruption exposures, in the event of a significant or catastrophe loss event should also be undertaken.

This helps ensure that risk controls, fire detection and protection systems, etc., are sufficient and reflective of the potential property loss estimates.

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

Managing Change

Any proposed changes to business activities, equipment and the premises relating to forklift usage and charging should be managed through a formal Management of Change process. This helps ensure all stages of the change are progressed with the minimal exposure to existing arrangements.

- These proposed changes should also be discussed with your property insurer and insurance broker.

Refer to the Aviva Loss Prevention Standards **Managing Change - Property** for further guidance.

Managing the Risks

External Charging

External charging sheds should be considered wherever possible. Removing charging stations to such buildings, located as far from buildings, valuable assets, and other combustible goods as achievable, reduces the potential for fire development and catastrophic fire losses.

- In most cases at least 10 metres separation is recommended, however this should be increased if there are concerns regarding the likelihood of fire spread due to the combustibility of buildings or the bridging of fire via external stocks or other equipment located between the charging shed and other buildings, valuable assets, etc.
 - ✓ Where adequate separation distances cannot be achieved, the installation of a fire barrier providing a fire resistance rating (insulation and integrity) of at least 60 minutes should be considered between the charging building and other buildings, valuable assets, etc.
- Any such charging building should preferably be of non-combustible materials. No other storage or activities should be undertaken within, and in proximity to such a structure.
- Charging equipment should be mounted at least 0.5 metres from the ground to reduce the risks of water ingress during a water related event e.g., flooding, heavy rainfall etc.
- In summer months or warmer climates, the upper safe operating temperatures of the batteries being charged should also be considered.
 - ✓ In uninsulated or exposed charging areas, excessive or prolonged temperatures may have an impact on the battery lifespan, liquid levels and charging. AGM and Gel type batteries can also swell due to pressure build up and rupture.
 - ✓ Appropriate automatic ventilation and cooling/heating systems should be installed to minimise the potential for overheating and be subject to routine testing, inspection and maintenance.

Note: Lead-acid battery powered lifting equipment may not be the best solution for use in cold stores, freezer rooms, etc., and guidance should be sought from a reputable supplier.

Internal Charging – Charging Rooms/Halls

Where external charging is not possible and a limited number of forklift trucks are utilised, a charging room or hall should be established and:

- Be of non-combustible construction providing a fire resistance rating (insulation and integrity), including the ceiling of at least 60 minutes.
- Be fitted with an appropriately tested and accredited fire door, providing at least 60 minutes fire resistance (insulation and integrity), and kept closed when not in use.
- Be fitted with automatically operating fire shutters to all wall openings, e.g., for vehicular access.
- Any lighting and other necessary electrical fittings have an appropriate explosivity rating, to reflect the potential presence of explosive vapours.
- Not used for any other purpose and a clear distance of at least 5 metres maintained between the store and its openings.
 - ✓ Marking the flooring to specify clearance distances is recommended.

Additionally, the store should not feature any other openings, such as windows and deposit/collection slots which open internally unless fitted with fire shutters also providing at least 60 minutes fire resistance.

- External openings, such as windows etc., should be assessed and similarly protected if there is potential for vertical fire spread across the external fascia of the building or fire entering the building via other openings above.
- Any openings for cabling and pipework etc. should be adequately fire stopped and/or fitted with intumescent collars to ensure the 60-minute integrity of the store is maintained in the event of ignition.
- Intumescent collars should be used to protect pipework which could collapse or melt in the event of fire, filling any voids created and providing a fire barrier.

Installation and maintenance of passive fire protection products such as fire stopping should be completed by experienced/accredited companies in accordance with local or national regulations, standards or codes, such as Loss Prevention Certification Board (LPCB) Loss Prevention Standard - **LPS 1531: Issue 1.2 Requirements for the LPCB approval and listing of companies installing or applying passive fire protection products** and LPCB Loss Prevention Standard - **LPS 1197: Issue 4.2 Requirements for the LPCB approval and listing of companies inspecting, repairing, and maintaining fire and security doors, door-sets, shutters, and active smoke/fire barriers** in the United Kingdom. Refer redbooklive.com for details of approved contractors.

Refer to Aviva Loss Prevention Standards **Fire Compartmentation** and **Fire Doors, Fire Shutters and Fire Dampers** for further guidance.

Depending on the number of forklift trucks on charge, explosion relief systems may be necessary. This should be assessed by a suitably competent person or Consultant within a risk assessment, and any recommended actions implemented.

Important: The compartment fire resistance rating should be increased to 90 to 120 minutes where more than three battery powered forklift trucks are charged at any one time, or as stipulated within relevant risk assessments.

Internal Charging – Segregation Only

The installation of a charging room or hall may not be viable in all buildings, e.g., space limitations etc. For premises featuring single battery powered forklift trucks, or large warehouses featuring single battery powered trucks in different warehouse cells, a dedicated charging area should be established and adequate clearance maintained from other forklift truck charging areas and combustible materials, such as some building linings, other contents, or stock.

- At least 2 metres clearance should be maintained, however this is the minimum separation distance and should be increased wherever possible.
- Do not place charging equipment on combustible materials, e.g., pallets, etc.
- Demarcation of the charging area using floor hatching is recommended, and the area routinely inspected for breaches of storage rules.
- Impact protection devices may be necessary to protect against the risk of vehicular damage to charging equipment.
- Where achievable, equipment should only be charged during periods of occupancy.
- Installing charging equipment within storage racking is not recommended under any circumstances.

Note: The charging of multiple forklift trucks is not recommended unless within a fire resisting compartment or within a dedicated charging shed.

Charging and Electrical Hazards

Charging places stress on batteries and is one of the main fire-related concerns. The increased load on the electrical supply, which if not well maintained or capable of supplying the demand safely, is also a potential source of ignition.

The following guidance can help reduce the risk of electric faults during charging operations.

- In all cases all manufacturers' recommendations and local regulatory requirements, standards or codes should be followed.
- All chargers should be installed and maintained in accordance with manufacturer's instructions and by a competent and accredited electrical contractor or company.
- The circuits supplying the chargers should be checked to ensure adequate capacity for the proposed additional electrical load.
- All chargers should be suitably rated for the devices they are due to charge.
- Surge protection safety devices should be installed and regularly tested.
- Where possible as much of the wiring should be hard-wired.
- Routing of cabling should be carefully considered, particularly if multiple cables are running through cable trays, as current draw may cause excessive heating within trays or conduits.
- All chargers should be clearly labelled and if different chargers or chargers with different ratings are proposed to be in used in the same area, the equipment should be grouped to help avoid confusion.
 - ✓ Users should ensure the right charger with the correct rating is being used to charge the corresponding battery/device in question.
- The design and layout of the area should ensure charging cables do not become overstretched, tangled, or can be damaged.
- All charging areas should be arranged with a clearly labelled and readily accessible master isolation switch, that is not in the same fire area as the charging equipment.
- Depending on the nature of the arrangements and chargers used, these should be considered within all required electrical fixed wiring or portable appliance testing.

- If any charging equipment is damaged or is faulty it should immediately be removed from use, repaired, or discarded and the charging equipment isolated safely as necessary.
- The use of extension leads should be expressly prohibited.
- Ensure the vehicle ignition is turned off and forklift keys/fobs should be removed.
- Ensure battery chargers are turned off before connecting the battery to the charger.
- Ensure workers are adequately trained on charging rules and procedures.
- The risk of water damage should be assessed and appropriately IP-rated equipment used where equipment is potentially exposed to rain or flood water etc. Charging infrastructure, chargers and cables should be stored and sited at least 0.5 metres from ground level to protect from water ingress in an escape of water, or other water related event.
- Thermographic cameras should be routinely used on the batteries and the charging equipment to check for hot spots and overheating components.
 - ✓ An annual formal thermographic inspection of the charging infrastructure is also recommended.

Refer to Aviva Loss Prevention Standards **Thermographic Surveys** and **Use of Thermographic Cameras - General Considerations** for further guidance.

Ventilation

To reduce the potential for fire or explosion events, charging locations should be adequately ventilated. Whilst manual ventilation may be suitable for single vehicles, mechanical means of ventilating charging areas should be installed for multiple vehicle charging areas.

The potential explosivity of emitted gases should be assessed, and ventilation systems rated as suitable for use in environments where flammable vapours may be present.

The exhaust point of the ventilation system should be to a safe area in the open, and not located in an area where any exhausted smoke could compromise the air intake of the building or that of neighbouring properties.

The ventilation system should be continuous, not actuated or stopped by performance of any fire protections and be subject to a formal inspection and maintenance programme by appropriately qualified and competent personnel.

Damaged or Faulty Batteries

Forklift trucks with damaged batteries should not be stored at the premises longer than is necessary, and a strict rule to this effect should be established within site rules and/or standard operating procedures (SOPs), detailing arrangements, and responsibilities for prompt collection by a reputable lift truck supplier.

Any such vehicles should be segregated and quarantined pending collection. Segregation should be:

- External and as far away from buildings, valuable assets, and combustible goods as possible (in most cases at least 10 metres separation is recommended).
- If external storage is not possible, a dedicated storeroom providing a fire resistance rating, including the ceiling, of 90 to 120 minutes or a segregated area at least 5 metres from combustible building linings, other contents, or stock.
 - ✓ Demarcation of the area using temporary barriers or warning signs is recommended.

The charging of forklift trucks with damaged or faulty batteries should be expressly prohibited within site rules and procedures.

End-of-Life Battery Management

All lead-acid battery types have a recommended lifecycle rating, this is typically up to five years, depending on site conditions and usage, and this information will be available in the product specifications or from the supplier/ maintenance company.

Ensure battery replacement is formally scheduled and battery health monitored closely during the final 12 months of the scheduled lifespan for signs of performance decline.

Important: You should not exceed recommended lifecycle charging, unless approved by your supplier.

Removed batteries should be collected immediately by the maintenance company, or stored in a segregated area and collected by a reputable waste recycling company.

Impact Protection

Risk assess the work environment for impact damage exposures, with particular focus to buildings and stored goods including stock/goods within racking.

- Impact protection should be installed to vulnerable areas such as vehicle openings in walls, storage racking, electrical or other high voltage plant, charging equipment, etc.
- Ensure impact protection devices are regularly inspected for damage and condition.

Automatic Fire Detection and Automatic Fixed Fire Protection

As a minimum, automatic fire detection should be provided in all forklift charging areas and connected to a reliable monitored, and constantly attended location. There should also be a manual means of raising the fire alarm.

Based on the values and business impact exposure, automatic sprinkler protection fed by a dedicated and reliable fire water supply should also be considered. This should be designed in accordance with an internationally recognised standard **LPC Rules for Automatic Sprinkler Installations Incorporating BSEN12845** in the United Kingdom.

Charging equipment should be interlocked to fire detection and fire protection equipment to ensure safe isolation of charging equipment upon activation of either system.

All designs and installations should be completed by approved/listed companies using equipment that is approved/listed to internationally recognised standards.

Refer to your property insurer and broker for specific guidance on automatic fire detection and fire suppression systems.

Self-Inspection

The self-inspection programme should include areas where forklift trucks are used or stored, and ensure:

- Site rules and policies on use, storage and charging are being followed, and any arising issues are appropriately actioned. This includes the removal of keys from unattended vehicles.
- Damage and faults are reported and appropriately actioned.
- Detection and protection equipment are functioning normally and not impaired.
- Other control measures, including fire shutters, remain in normal working order.
- Thermographic cameras are used to check equipment when under charge.

Refer to Aviva Loss Prevention Standards **Self-Inspections** (which includes a checklist) and **Use of Thermographic Cameras - General Considerations** for further guidance.

Maintenance, Inspection and Testing.

- Ensure forklift trucks and charging equipment are subject to formal maintenance arrangements as per Original Equipment Manufacturer (OEM) and/or supplier guidelines.
- Any hot works undertaken during maintenance works should be conducted in strict accordance with the Aviva Loss Prevention standard **Hot work Operations**.
 - ✓ Thermographic cameras should be used throughout the process and during fire watches.
 - ✓ Fire watches should be undertaken for up to 240 minutes after the hot works, and only reduced where supported by a specific risk assessment.
 - ✓ A minimum fire watch period of 120 minutes should be enforced.

Refer to Aviva Loss Prevention Standards **Maintenance Regimes** and **Hot Work Operations** for further guidance.

Fire and Rescue Service

Local Fire and Rescue Services are often amenable to inspecting premises to evaluate fire risk exposures, firefighting response and offer guidance.

It is also important to maintain suitable access for the Fire and Rescue Services and consider the distances and location to the nearest source of firefighting water or hydrant that they may need to use.

- The location and number of fire hydrants in the proximity of the premises should be documented in an emergency response plan or shown on appropriate drawings.

It is also good risk management practice to know what water supplies are available for the Fire and Rescue Service to use. Therefore, site management should always establish:

- What fire water is available.
- Static pressure, flow and residual pressure test results.
- Whether additional resources, such as a private hydrant system or water storage tanks are necessary.

Please refer to the Aviva Loss Prevention Standard **Manual Fire Fighting Water Supplies** for further guidance.

Emergency Response

An emergency response plan should be produced to specifically outline key responsibilities and actions in an emergency event. The emergency response plan should include responses to all likely property and business interruption related events as described in this Loss Prevention Standard. It should also include the actions key individuals should take during emergency events.

The emergency response rules should be documented and training provided.

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

Business Continuity Planning

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

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

Key Actions

- Undertake all regulatory risk assessments and a material damage risk assessment to help identify main risks and recommended risk control measures.
- Segregate forklift charging within a dedicated building wherever possible, located at least 10 metres from other buildings and valuable assets.
- Where this is not possible, use a fire resisting compartment for charging forklift vehicles.
 - ✓ At least 60 minutes fire resistance is recommended (insulation and integrity) where less than three vehicles are charged and at least 90 minutes where more than three trucks are in use.
- Where this is not possible, create a dedicated charging location and keep the area clear of combustible materials.
 - ✓ At least 2 metres clearance should be maintained (5 metres for lithium-ion battery powered forklift trucks) between combustible items. This should be increased wherever possible.
- Maintain at least 2 metres clearance between other forklift truck charging locations.
- Formalise charging rules/SOPs.
- Ensure fire detection and fire protection systems are adequate and interlocked to charging equipment. Activation of either should safely isolate charging equipment.
- Adopt strict policies for segregation of forklift trucks with damaged batteries.
- Ensure electrical and ventilation systems in charging areas are rated for use in areas where flammable vapours may be present.
- Carry out regular self-inspections for condition of equipment, breaches of site rules and guidelines, etc.
- Ensure workers are adequately trained on charging risks.
- Adopt appropriate emergency response procedures.

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Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners.

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

Sources and Useful Links

- [The Dangerous Substances and Explosive Atmospheres Regulations 2002.](#)
- [The Regulatory Reform \(Fire Safety\) Order 2005.](#)
- [The Fire Safety \(Scotland\) Regulations 2006.](#)
- [The Fire \(Scotland\) Act 2005.](#)
- [The Fire and Rescue Services \(Northern Ireland\) Order 2006.](#)
- [LPS 1271: Issue 2.3 Requirements for the LPCB Approval and Listing of Companies Installing Fire or Security Doors, Door-sets, Shutters and Active Smoke/Fire Barriers.](#)
- [LPS 1197: Issue 4.2 Requirements for the LPCB approval and listing of companies inspecting, repairing, and maintaining fire and security doors, door-sets, shutters, and active smoke/fire barriers.](#)
- [HSE document INDG139 Using electric storage batteries safely.](#)
- [Redbooklive.](#)

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:

- **Business Continuity.**
- **Contamination Following a Fire.**
- **External Building Areas - Usage and Safety.**
- **Fire Compartmentation.**
- **Fire Doors, Fire Shutters & Fire Dampers.**
- **Fire Safety Inspections.**
- **Fire Safety Legislation.**
- **Heat and Smoke Venting Systems.**
- **Managing Change - Property.**
- **Smoke Contamination.**
- **Thermographic Surveys.**
- **Use of Thermographic Cameras - General Considerations**
- **Use of Thermographic Cameras - Checklist**
- **Lithium-ion Batteries - Storage and Transit**
- **Environmental, Social and Governance Overview**

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