Fire Protection Association

RISCAuthority

RC59: Recommendations for fire safety when charging electric vehicles

RISK INSIGHT, STRATEGY AND CONTROL AUTHORITY

REDUCING INSURABLE RISK THROUGH RESEARCH, ADVICE AND BEST PRACTICE

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IMPORTANT NOTICE

Contents

Summary of key points

This document has been developed through the RISCAuthority and published by the Fire Protection Association (FPA). RISCAuthority membership comprises a group of UK insurers that actively support a number of expert working groups developing and promulgating best practice for the protection of people, property, businesses, and the environment from loss due to fire and other risks. The table below summarises the key points of the document.

Fire risk assessment	• Practical passive, active, and managerial control measures should be considered as part of the fire risk assessment for the premises when selecting and designing areas for use as electric charging points.
Fire safety management	• When selecting sites for charging points, sufficient space must be allowed for vehicles to be parked safely in the designated charging area, and for connection to be made to the charging equipment. Adequate space should be allowed to manoeuvre other vehicles around charging vehicles safely when necessary. • All relevant staff should be trained in the safe use of the chargers for vehicles that they are responsible for.
General considerations	• Charging bays should be signed and marked prominently on the ground to allow vehicles to park close to the charging point, and prevent the stretching of charging cables. The length of charging cables should be sufficient to allow their use with the intended equipment without risk of damage. • Charging points for electric road vehicles operated by a company, together with those provided for visitors' transport, should normally be located outside the premises. • Charging points should be protected against mechanical damage by vehicles. For example, they should be installed above ground level and be located on a raised island, or be protected by kerbs, bollards, or metal barriers. • Where multiple chargers are in use, there should be clear and prominent notices at each charging point, indicating for which equipment or vehicle(s) it is suitable. • Where charging points are to be provided in multi-storey car parks, consideration should be given to locating these in open areas with good -access for fire-fighting. • Avoid excessive temperatures and humidity in inside electric vehicle (EV) charging areas. The temperature of the charging area should not be such that overheating may occur during the charging process.
Electrical provisions	• Where rapid charging points – known as 'DC fast charge' and operating at 500V DC – are provided, they should be clearly differentiated from conventional charging points because of the hazards associated with the direct current. • A circuit intended to supply an electric vehicle must be fit for purpose and suitable for the electrical load. • Where a BS 1363-2 (ref. 6) socket outlet is used for electric vehicle charging, it must be marked 'EV' on the back of the socket unless there is no possibility of confusion, and a label must be put on the front face or adjacent to the socket outlet or its enclosure stating 'suitable for electric vehicle charging'.

Symbols used in this guide


Good practice


Bad practice


Discussion topic

Frequently asked question

1 Introduction and scope

FAQ

Approved Document S, 2021 edition (issued by HM Government); 'Infrastructure relating to the charging of Electric Vehicles', intended to significantly enhance the EV charging infrastructure in England applies to:

- New residential buildings
- New non-residential buildings
- Buildings undergoing a material change of use
- Residential buildings undergoing major renovation
- Non-residential buildings undergoing major renovation
- Mixed-use buildings undergoing relevant building work

With a few exceptions, buildings undergoing these works will require the installation of a 7kW-rated EV charge point(s), or cable routes capable of providing supply.

However, this Approved Document does not provide guidance on electrical or fire safety.

Advances in technology and concern for the environment have created an increasing demand for electric vehicles (EVs) for both private and commercial use. This guide focusses on fire hazards and good-practice risk control measures for the charging of EVs using lithium-ion batteries, driven on highways, (i.e. cars, motorcycles, bicycles, lorries, coaches/buses, etc.) Lithium-ion batteries are the predominant type of rechargeable battery used in EVs.

The charging of forklift trucks is outside the scope of the recommendations in this guide but are addressed in RC11: *Recommendations for the use of lift trucks* (ref. 1).

Guidelines for fire safety in use of mobility scooters can be found in National Fire Chiefs Council (NFCC): *Mobility scooter guidance for residential buildings* (ref. 2).

For general fire safety guidance for lithium-ion batteries refer to RE2 *Need to Know Guide*, Lithium-ion battery use and storage (ref. 18). For batteries other than lithium-ion refer to RC61: *Recommendations for the storage, handling, and use of batteries* (ref. 3).

The increasing use of electric vehicles has necessitated the provision of charging facilities that if not managed appropriately, can introduce potential ignition hazards into the workplace, or public areas, such as motorway service areas and car parks, as well as into dwellings where EVs are charged.

These recommendations are intended to give practical advice regarding fire safety aspects of the provision, management, and use of electric transport charging points, and do not aim to repeat the technical requirements concerning their installation that are covered in the *IET Code of Practice: EV Charging Equipment Installation/BS 7671 – 18th Edition wiring regulations*, Section 722 (Electric Vehicle Charging Installations) (ref. 4).

2 Synopsis and hazards

These recommendations provide practical guidance on fire hazards and appropriate control measures associated with the provision, management, and use of charging points for EVs. Advice is provided concerning the charging provisions, the areas where this process should be undertaken, and appropriate fire protection measures that should be considered.

Lithium-ion batteries are the predominant type of rechargeable battery used with electric vehicles. Many millions of lithium-ion batteries are in use and in storage around the world. Fortunately, fire-related incidents with these batteries are infrequent. But the hazards associated with lithium-ion battery cells, which combine flammable electrolyte and significant stored energy, can lead to a fire or explosion from a single-point failure.

If a battery cell creates more heat than it can effectively dissipate it can lead to a rapid, uncontrolled release of heat energy, known as 'thermal runaway', that can result in a fire or explosion. Thermal runaway can lead to the ejection of a range of gases from battery casings, such as hydrogen (flammable), carbon monoxide (toxic, asphyxiant, and flammable), and hydrogen fluoride (acutely toxic and corrosive). The highest risk of fire occurs when lithium-ion batteries are being charged, particularly if a cell is defective and unable to correctly convert the supplied electrical energy into stored chemical energy.

When a battery cell vents or ruptures due to thermal runaway, immediate ignition of the emitted gases can occur (especially for batteries with a high level of charge). Alternatively, the gases may spread-out unignited, with the potential for a deflagration (very rapid combustion) or explosion if an external ignition source is encountered.

3 Recommendations

3.1 General considerations

3.1.1 When selecting sites for charging points, sufficient space must be allowed for vehicles to be parked safely in the designated charging area, and for connection to be made to the charging equipment. Charging equipment and cables should not interfere with any access or emergency egress routes.

3.1.2 Mark vehicle parking bays clearly on the ground. This should include sufficient space to gain access to the vehicle, with a minimum 1,200mm wide transition zone between parking bays for disabled users. It is good practice to design all EV charging bays for disabled users, to provide both a high degree of inclusive access and additional vehicle-to-vehicle lateral separation.

3.1.3 The nature of charging equipment requires it to be installed in the immediate vicinity of vehicles. The fire risk assessment should include the suitability of the location and the nature of the equipment for the intended purpose.

- It is good practice to design all car park EV charging bays for disabled users, to enhance vehicle-to-vehicle lateral separation with addition of 1,200mm wide transition zones between parking bays, as well as providing a high degree of inclusive access to EV chargers.

3.1.4 In commercial and industrial premises where the batteries of electric vehicles are charged, the fire hazards and thus the threats to the business are increased by the need for the charging process to continue during the night or over weekends, when very few or no staff are present. It is therefore paramount that careful consideration be given to all fire and safety implications when charging areas are being selected and designed. Further information is set out in RISCAuthority Recommendations RC42: *Unattended processes* (ref. 5).

3.1.5 Fire risk assessments for commercial and industrial premises should consider the risk from charging electric vehicles. The measures to be considered should include:

i. physical segregation of the charging areas from process and storage areas (see section 3.3)

ii. provision of suitable power supply, control, and isolation systems, which will allow isolation of the charging points from a safe location without having an impact on business production and process functions

iii. risk control provision for when premises are unoccupied

iv. suitable automatic fire detection and warning installations in case of fire

v. provision of portable firefighting equipment, together with fixed fire suppression systems where the latter is proportional to the risk

vi. development of an emergency action plan to protect life and property, and ensure the continued functioning of the business in the case of fire

vii. staff training in the safe use of charging equipment and the actions to take in the event of fire, including the safe isolation of power from the charging station and evacuation of the premises

Similar consideration should apply to EV charging arrangements in residential environments, especially for buildings where people may be sleeping.

3.1.6 No flammable or combustible material should be stored within designated charging areas (see section 3.3).

3.1.7 Security or other responsible staff on site who may be called to act in an emergency should be made aware of the location of the charging area(s), the means for isolating the power, and the actions that should be taken to raise the alarm.

3.1.8 All relevant staff should be trained in the safe use of the chargers for vehicles that they are responsible for. This training should include the undertaking of visual inspections of the charging equipment prior to each use. Damaged and defective equipment should be reported immediately, isolated, taken out of service pending repair, and visible warning notice and/or barrier placed to prevent use.

3.1.9 Charging points for electric road vehicles operated by a company, together with those provided for visitors' transport, should normally be located outside the premises and provided with suitable and adequate lighting for using the equipment and security.

3.1.10 Electric bicycles owned by staff should be charged in a secure fire compartment or a detached single-storey structure (see section 3.3).

3.1.11 Vehicles must only be charged in accordance with the manufacturer's instructions.

Charging points for electric car chargers, electric bikes, and electric scooters should be separated by fire resisting construction or by space-separation, suitably arranged and clearly marked for their intended purpose. See section 3.3.

3.1.12 Avoid excessive temperatures and humidity inside EV charging areas. The temperature of the charging area should not be such that overheating may occur during the charging process.

3.1.13 Where charging points are to be provided in multi-storey car parks, serious consideration should be given to locating these in open areas with good access for firefighting.

3.1.14 Where car parks are located beneath ground level, consideration should be given to providing sprinkler protection at the planning stage.

Sprinklers provide the best form of active fire protection for enclosed car parks (see section 3.4).

3.1.15 Only EVs, including electric bikes and scooters, with Original-Equipment-Manufacturers' (OEM) factory-fitted batteries should be charged. The only exception is for where OEM approved compatible replacement batteries have been fitted by a competent person.

3.1.16 Car park charging bays should be signed and marked prominently on the ground to allow vehicles to park close to the charging point, and prevent the stretching of charging cables. The length of charging cables should be sufficient to allow their use with the intended equipment without risk of damage.

3.1.17 Charging points should be protected against mechanical damage by vehicles. For example, they should be installed above ground level and be located on a raised island, or be protected by kerbs, bollards or metal barriers.

3.1.18 Lithium-ion batteries that are no longer required should be disposed of appropriately.

See RE2 Need to Know Guide, *Lithium-ion battery use and storage* (ref. 18).

3.2 Charging equipment

3.2.1 There are a number of different types of charging plugs on the market, covering both AC and DC charging. With the UK 3-pin, Type 1, and Type 2 connectors being used for AC charging and CHAdeMO® and CCS used for DC charging. Although a lot of manufacturers are settling on the Type 2 or CCS (Type 2 plus rapid DC connection) for UK or European markets. Whilst Tesla have created slightly modified connectors known as Tesla Type 2® and Tesla CCS®. The choice of connector therefore depends on the charger type, and the vehicle's inlet port.

FAQ

- Currently home chargers are normally powered from single phase 240v, 32Amp connections to the building consumer unit. Commercial and residential-block chargers use typically use 3 phase 415v supply with Amperage output varying from 32A up to 200A; the higher the Amps the faster the charge.

3.2.2 UK 3-pin EV chargers, sometimes referred to as a 'granny charger' due to the slow charge rates, are not designed to be the everyday source of charging EV's. The 3-pin socket is not designed to provide such large amounts of power for long periods of time and generates large amounts of heat. Some manufacturers recommend that using an extension cable is avoided, if at all possible, as many extension cables are not suitably rated and drawing maximum current for a long period of time can potentially be dangerous.

These should only be used as a last resort or for emergency (additional mileage) situations.

3.2.3 The use of extension cables in public areas should be prohibited.

3.2.4 Vehicle charging points (other than EV chargers fitted with a 13A plug) must be installed by a competent electrician.

- Avoid using extension leads with portable (granny) chargers. These should only be used as be used as a last resort or for emergency (additional mileage) situations

3.2.5 Where rapid charging points – known as 'DC fast charge' and operating at 500V DC – are provided, they should be clearly differentiated from conventional charging points because of the hazards associated with these chargers.

3.2.6 All chargers and associated equipment should be installed, used, and maintained in accordance with the manufacturer's instructions. Internal installations should comply with the requirements of BS 7671 (ref. 4). Servicing and maintenance should be carried out by a competent electrician.

3.2.7 Where a BS 1363-2 (ref. 6) socket outlet is used for electric vehicle charging, it must be marked 'EV' on the back of the socket unless there is no possibility of confusion, and a label must be put on the front face or adjacent to the socket outlet or its enclosure stating 'suitable for electric vehicle charging'.

3.2.8 A risk assessment should be undertaken to consider forms of damage, either accidental or deliberate, to which charging points may be subject. Where appropriate, external charging points may need to be protected against deliberate damage out of working hours by being located in a secure area, equipped with security lighting and monitored by CCTV cameras. Dedicated power supplies for external charging points should be run in metal trunking, steel conduit, and/or underground ducting.

3.2.9 Emergency manual isolation of charging points should be provided to ensure safe shutdown of equipment in the event of a fault on the mains electrical supply. The isolation point(s) should be prominently signed and strategically located where it will be readily accessible to trained staff and firefighters.

3.2.10 Emergency isolation switches should incorporate lock-out facilities to prevent unauthorised reinstatement during maintenance and emergencies.

3.2.11 Power circuits should be configured to require manual resetting of the isolator when the power is restored.

3.2.12 When a charger is found to be faulty, its use should cease immediately and it should be isolated and locked out, with a suitable warning sign being displayed prominently until satisfactory repairs have been made by a competent technician.

3.3 Compartmentation and segregation

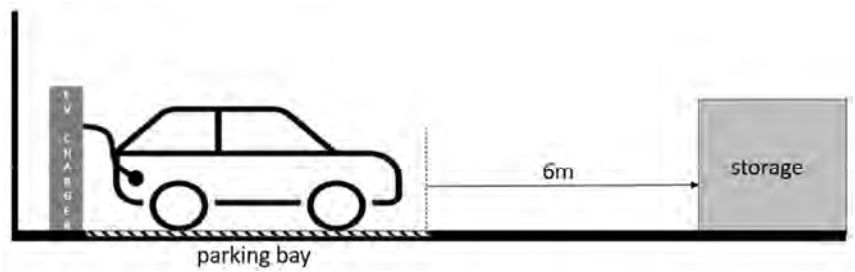
3.3.1 On commercial and industrial sites where it is not possible to provide external, roadside-style charging points, use of inside areas should be suitably risk assessed.

3.3.2 Where possible, any inside charging points should be located in a detached, single-storey structure.

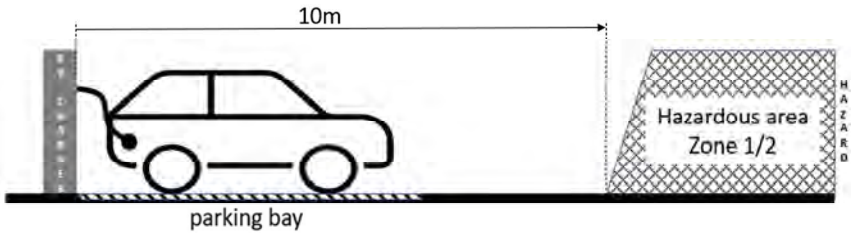
- Increased compartmentation and separation criteria may be appropriate based on the outcome of specific fire risk assessments or individual property insurer's expectations.

3.3.3 Where a detached structure is not available, the enclosure should provide at least 60 minutes fire resistance between the charging area and any other part of the premises. Where there is access to the premises from the charging area, the doorset(s) or shutters should provide the same degree of fire resistance as the structure in which they are located (i.e. at least 60 minutes fire resistance).

3.3.4 Enclosed charging areas must be free from storage, including waste materials, with a separation of at least 6 metres.



3.3.5 Where hazardous installations, such as ignitable liquids storage, are present, EV charging points should be separated from the edge of hazardous areas (Zone 1 or 2, ATEX) by a minimum of 10 metres. This minimum separation distance shall be extended for vehicles >5 metres long, to be equivalent to the full length of the vehicle, plus 5 metres.



3.3.6 Detailed guidance for EV charger installations at fuel-filling stations is published by the IET (The Institution of Engineering and Technology) and the APEA (the Association for Petroleum and Explosives Administration) (ref. 7)

Note: a "hazardous area" is defined as any place in which an explosive atmosphere may occur in quantities such as to require special precautions (ref. 8).

3.3.7 Because of the intense and prolonged nature of fires involving lithium-ion batteries, where it is necessary to locate charging areas in basements, careful consideration should be given to the design of the sprinkler system and ventilation arrangements. There should also be liaison with the Fire and Rescue Service concerning access for firefighting. Basement level parking garages with EV chargers should be separated from other parts of the premises by elements of structure that provide at least 120 minutes fire resistance.

Note: basement parking areas are typically associated with multi-storey office and residential buildings, where outside parking areas are unavailable or limited.

3.4 Fire protection

3.4.1 A fire involving a lithium-ion car battery can burn for a prolonged period of time (for many hours).

Lithium-ion car batteries experiencing thermal runaway will typically either rupture or vent through integrated rupture discs, releasing a jet of flammable gases from the underside of the vehicle, igniting to form a short-duration jet-fire. From observed EV car fires, this jet is typically 2-3 metres in length. The direction of jet depends on individual battery design and failure mode.

Studies by The Danish Institute of Fire and Security Technology and NFPA (refs 9, 10) have both determined that EV car fires, once established, are largely fueled by the car parts and interiors made from plastic materials and that fire loading is similar to that of internal combustion engine (ICE) vehicles.

However, it should be noted that even where an EV fire has apparently been extinguished, there have been cases when a vehicle lithium-ion battery has reignited due to the recurring thermal event in the battery. This may be exacerbated if the vehicle is disturbed or shaken by moving/dragging to another location.

Refer to: DoT "*Recovery operators: working with electric vehicles*" (ref 11).

Fire control strategies for EV vehicles require combinations of containment, reduction of fire intensity by smothering (reducing oxygen levels), and cooling with water to inhibit fire spread whilst the battery cell fires burn-out. Fire response strategies should be subject to a fire risk assessment and emergency response plan, and in all circumstances only suitably trained emergency responders should attempt to control and extinguish EV fires.

FAQ

- Evidence derived from global research and research conducted by the BRE in their 2010 report Fire spread in car parks considered the effectiveness of sprinklers controlling fires in car parks and said; "the incidence of fatalities and injuries is zero and the property loss is around 95% lower than that of an uncontrolled fire". Ref: SCOSS ALERT Feb 2018
  Also: the National Fire Chiefs Council's (NFCC) strongly recommends that enclosed car parks be fitted with sprinklers, as is common in Europe and recommended by NFPA (National Fire Protection Association) in the USA.

3.4.2 Internal charging areas for electric vehicles should be protected by suitably designed automatic fire detection (AFD) installations. In commercial and industrial facilities, AFD should be installed by contractors with appropriate certification by an independent, UKAS accredited third-party certification body. Installations should be installed to a minimum P2 standard, in accordance with BS 5839-1 (ref. 12).

3.4.3 AFD installations in commercial and industrial facilities should be monitored, either on site or by an off-site alarm receiving centre with accreditation by an independent, UKAS accredited third-party certification body.

3.4.4 Multi-tenanted residential blocks with internal or underground EV charging areas, should be treated the same as commercial and industrial facilities (above).

3.4.5 The AFD installation should be tested weekly in accordance with BS 5839-1, with suitable records being kept.

3.4.6 The AFD installation should be periodically serviced and maintained in accordance with BS 5839-1, by a competent service engineer with appropriate certification by a UKAS accredited third-party certification body.

3.4.7 Sprinklers provide the best form of active fire protection for enclosed car parks. Sprinkler protection is strongly recommended for enclosed car parks with EV charging points.

Where provided, design and install sprinklers in accordance with appropriate specifications for enclosed car parking areas to the LPC Sprinkler Rules incorporating BS EN 12845 (or equivalent and recognised property sprinkler rules, e.g. NFPA 13 & 88A) (Ref's 13, 14, 15).

Note, as with other fire hazards, sprinklers are designed to control the spread of the fire but will probably not extinguish the fire itself.

Burning EV car batteries are shielded undeath the body of the car and water will not be able to penetrate battery casings. Final fire control and extinguishment relies on the Fire and Rescue Service.

3.4.8 Sprinkler installations should be designed, installed, commissioned and maintained in accordance with the LPC Sprinkler Rules incorporating BS EN 12845 (ref 13), or to equivalent and recognised property sprinkler rules, by contractors having appropriate certification from an independent UKAS accredited third-party certification body.

3.5 Emergency and business continuity planning

3.5.1 Even a small fire can have a disproportionate effect on a business if it occurs in a critical area.

All organisations should take steps to ensure the continued smooth running of their business by developing a suitable emergency plan. The emergency plan should address the implications of a fire, flood, or other perceived disaster on all facets of the business model.

3.5.2 Clear and concise hazard information should be available for the Fire and Rescue Service on their arrival. An information-box for firefighters should include the locations of EV charging points and facilities for their electrical isolation.

Guidance for this is set out in Business Resilience: A Guide to protecting Your Business and its People (ref. 16).

3.5.3 The emergency plan should be rehearsed, with the results being assessed and amendments made to the plan as necessary.

3.5.4 Businesses should also develop a suitable business continuity plan (BCP) that outlines how a business will continue to operate during an unplanned process or service disruption. The BCP should contain contingencies for every aspect of the business that might be affected, including manufacturing and business processes, assets, business administration, and business partners.

3.5.6 Plans typically contain a checklist that includes supplies and equipment, data backups, and backup site locations. Plans should identify plan administrators, key personnel and include contact information for emergency action response personnel, and services, and should specify the lines of communication that should be followed. Plans should also provide detailed strategies on how business operations can be maintained for both short-term and long-term outages.

3.5.7 Action response services should include plans for specialist assistance that may be required, including specialist chemical clean-up crews, due to potential toxic residue and heavy metals deposits from the thermal event processes in a lithium-ion battery fire.

3.5.8 Consideration may be given to applying RISCAuthority BCP tools and software. BCP tools are available from the Fire Protection Association website: thefpa.co.uk. Sophisticated BCP software is commercially available.

3.6 Compliance with fire safety legislation

3.6.1 Where appropriate, an assessment in compliance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR)(ref. 8) should be undertaken, to ensure that charging areas are sufficiently remote from any hazard zones and locations used for the storage of hazardous or flammable liquids and gases.

3.6.2 In premises to which the Regulatory Reform (Fire Safety) Order 2005 (or equivalent legislation in Scotland and Northern Ireland)(ref. 17) applies, the fire safety management strategy should consider practical passive, active, and managerial control measures as part of the fire risk assessment for the premises when selecting and designing areas for use as EV charging points.

3.6.3 Like any fixed electrical installation, Duty Holders are required under the Electricity at Work Regulations 1989 (EAWR)(ref. 19) to ensure the safety of EV charging points. This includes maintaining electric vehicle systems to prevent, so far as is reasonably practicable, any danger to employees, visitors, or other persons.

4 Glossary

FAQ

- Current UK regulations (at time of publication) restrict use of e-scooters on public highways to government trials within approved rental schemes. These restrictions may be lifted or amended in future UK legislation. Scooter charging points or areas may currently be encountered in zones where approved e-scooter rental schemes operate.

Battery

A device consisting of one or more cells in which chemical energy is converted into electrical energy for use as a source of power.

Each cell consists of an anode (or negative electrode) and a cathode (or positive electrode) separated by an electrolyte. The electrodes cause negatively charged ions (anions) and positively charged ions (cations) to migrate to their respective electrodes.

Batteries may be primary, which are designed for a single use and may not be recharged, or secondary, which are of a different design and may be recharged multiple times for reuse. The recommendations in this guidance apply to secondary batteries.

Electric bicycle

A bicycle with an integrated electric motor that can be used to provide, or assist in, the provision of propulsion.

The UK Government defines electrically assisted pedal cycles (EAPCs) with the following criteria:

- an EAPC must have pedals that can be used to propel it
- its electric motor must have a maximum power output of 250 watts and should not be able to propel the bike when it's travelling more than 25 km/hr (15.5mph)
- an EAPC can have more than 2 wheels (for example, a tricycle).

Electric vehicle

An electric vehicle (EV) is a vehicle that operates on an electric motor powered from rechargeable batteries, rather than an internal combustion engine (ICE).

E-scooter

The UK Government defines an electric (E) scooter as a motor vehicle which:

- is fitted with no motor other than an electric motor
- is designed to carry one person in a standing position with no provision for seating
- has a maximum speed of 20 km/hr (12.5 mph)
- has 2 wheels, one front and one rear, aligned along the direction of travel
- has a mass, excluding the rider, not exceeding 35 kilograms
- has means of directional control via the use of handlebars
- has means of controlling the speed via hand controls and its power control defaults to the 'off' position.

Hybrid vehicle

A hybrid electric vehicle (HEV) is a type of vehicle that combines an internal combustion engine (ICE) system with an electric propulsion system. Cars with internal combustion engines fuelled by petrol, diesel, or LPG and with auxiliary electric motors are the most common form of hybrid vehicle.

5 Checklist

		Yes	No	N/A	Action required	Due date	Sign on completion
5.1	**General considerations (section 3.1)**						
5.1.1	Has sufficient space been allowed for vehicles to be parked safely in the designated charging areas, and for connections to be made to the charging equipment in a safe manner?						
5.1.2	Is there adequate space to manoeuvre other vehicles around charging vehicles safely?						
5.1.3	Are vehicle parking areas clearly marked on the ground, with sufficient space to gain access to vehicles? Does car-to-car separation include provision for disabled users?						
5.1.4	Are charging areas free of flammable and combustible materials?						
5.1.5	Are security and other responsible staff on site who may be called to take action in an emergency aware of the location of the charging area, the means for isolating the power, and the actions that should be taken to raise the alarm?						
5.1.6	Are all relevant staff trained in the safe use of the chargers for vehicles that they are responsible for?						
5.1.7	Where multiple chargers are in use, are there clear and prominent notices at each charging point indicating which equipment or vehicle(s) it is suitable for?						
5.1.8	Is a visual inspection of the charger made prior to each use, with any damaged equipment being prominently labelled to indicate that it is no longer serviceable?						
5.1.9	Are temperature and humidity in inside EV charging areas within suitable limits?						
5.1.10	Are only EVs with Original Equipment Manufacturers' (OEM) factory-fitted batteries charged? (The only exception is where OEM-approved compatible replacement batteries have been fitted by a competent person.)						
5.1.11	Are charging points for electric car chargers, electric bikes, and electric scooters separate, suitably arranged, and clearly marked for their intended purpose?						
5.1.12	Where charging points are provided in multi-storey car parks, are these located in open areas with good-access for firefighting.						
5.2	**Charging equipment (section 3.2)**						
5.2.1	Have all charging points (other than EV chargers fitted with a 13A plug) been installed by a competent electrician?						
5.2.2	Where rapid charging points – known as DC fast charge and operating at 500V DC – are provided, are they clearly differentiated from conventional charging?						
5.2.3	Are all chargers and associated equipment installed, used, and maintained in accordance with the manufacturer's instructions?						
5.2.4	Is servicing and maintenance carried out by a competent electrician?						

		Yes	No	N/A	Action required	Due date	Sign on completion
5.2.5	Are charging bays signed and marked prominently on the ground to allow vehicles to park sufficiently close to the charging point to prevent the stretching of charging cables?						
5.2.6	Are charging points protected against mechanical damage by vehicles?						
5.2.7	Is the parking of vehicles in designated charging areas, other than for charging purposes, prohibited?						
5.2.8	Are emergency manual isolation of charging points provided to ensure safe shutdown of equipment in the event of a fault on the mains electrical supply?						
5.2.9	Do emergency isolation switches incorporate lock out facilities to prevent unauthorised reinstatement during maintenance and emergencies?						
5.2.10	Have all power circuits been configured to require manual resetting of the isolator when the power is restored?						
5.2.11	Is the isolation point(s) prominently signed and strategically located where it will be readily accessible to trained staff and firefighters?						
5.2.12	When a charger is found to be faulty, does its use cease immediately, with a suitable warning sign being displayed prominently, until satisfactory repairs have been made by a competent technician?						
5.2.13	Is the use of UK 3 pin EV 'granny chargers' avoided, or are these only used as a last resort or for emergency (additional mileage) situations, under close supervision?						
5.2.14	Is the use of extension cables in connection with use of "granny chargers" avoided and prohibited in public areas?						
5.3	**Compartmentation and segregation (section 3.3)**						
5.3.1	On commercial and industrial sites where it is not possible to provide external, roadside-style charging points, have inside charging areas been suitably risk assessed? Where possible, are inside charging points located in a detached, single-storey structure?						
5.3.2	Are enclosed charging areas free from storage, including waste materials, with a separation of at least 6 metres?						
5.3.3	Do any hazardous installations, such as ignitable liquids storage, have a minimum of 10 metres separation between EV charging points and the edge of hazardous areas (Zone 1 or 2, ATEX)?						
5.3.4	Are any basement charging areas separated from other parts of the premises by elements of structure that provide at least 120 minutes fire resistance, with careful consideration having been given to the design of their sprinkler systems and ventilation arrangements?						
5.3.5	Are internal charging areas for electric vehicles protected by suitably designed automatic fire detection (AFD) installations?						
5.3.6	Have AFD installations (commercial & industrial facilities and multi-tenanted residential blocks) been installed by contractors with appropriate certification by an independent, UKAS accredited third-party certification body, to a minimum P2 standard, in accordance with BS 5839-1?						

		Yes	No	N/A	Action required	Due date	Sign on completion
5.3.7	Are AFD installations (commercial & industrial facilities and multi-tenanted residential blocks) monitored, either on site or by an offsite alarm receiving centre with accreditation by an independent, UKAS accredited third-party certification body?						
5.3.8	Is the AFD installation tested weekly in accordance with BS 5839-1, with suitable records being kept?						
5.3.9	Is the AFD installation periodically serviced and maintained in accordance with BS 5839-1 by a competent service engineer with appropriate certification by a UKAS accredited third-party certification body?						
5.3.10	Are sprinkler systems in areas with EV charging points appropriately designed for enclosed car parking areas, and installed, commissioned, and maintained in accordance with the LPC Sprinkler Rules incorporating BS EN12845, or to equivalent and recognised property sprinkler rules, by contractors having appropriate certification?						
5.4	**Business continuity (section 3.5) and other considerations/legislation**						
5.4.1	Has an emergency plan been prepared, is it up-to-date, and has it been rehearsed?						
5.4.2	Does the emergency plan address the problem of fires involving batteries having the capacity to burn for prolonged periods of time?						
5.4.3	Has a fire risk assessment of the premises been carried out, and does this consider practical passive, active, and managerial control measures?						
5.4.4	Does the assessment address the continuing suitability of the location and any changes to the charging equipment?						
5.4.5	Has an assessment been made to ensure that the charging area remains sufficiently remote from any hazard zones identified in a DSEAR assessment?						
5.4.6	Does the risk assessment consider the hazards of charging electric vehicles when premises are unoccupied, or where people may be asleep?						

6 References

1. RISCAuthority RC11: *Recommendations for the use of lift trucks.*
2. National Fire Chiefs Council (NFCC): *Mobility scooter guidance for residential buildings*, 2018.
3. RISCAuthority RC61: *Recommendations for the storage, handling, and use of batteries.*
4. *IET Code of Practice: EV Charging Equipment Installation / BS 7671 – 18th Edition wiring regulations*, Section 722 (Electric Vehicle Charging Installations).
5. RISCAuthority Recommendations RC42: *Fire safety of unattended process.*
6. BS 1363-2: *13 A plugs, socket-outlets, adaptors, and connection units – Specification for 13 A switched and unswitched socket-outlets.*
7. *Electric Vehicle Charging Installations at Filling Stations (A supplement to the Code of Practice for Electric Vehicle Charging Equipment Installation)*, The Institution of Engineering and Technology (IET) and the Association for Petroleum and Explosives Administration (APEA).
8. Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR).
9. *Fire safety in garage systems, storage of lithium-ion batteries and batteries for photovoltaic systems in buildings*; DBI (Danish Fire and Safety Institute) and TI (Danish Technological Institute), 2022.
10. *Modern vehicle hazards in parking structures and vehicle carriers*; NFPA Research Foundation, 2020.
11. Department of Transport: *Recovery operators: working with electric vehicles*, 2022.
12. BS 5839-1: 2017 *Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning, and maintenance of systems in non-domestic premises.*
13. *LPC Sprinkler Rules incorporating BS EN 12845.*
14. NFPA 13: *Standard for the Installation of Sprinkler Systems.*
15. NFPA 88A: *Standard for Parking Structures.*
16. RISCAuthority *Business Resilience: A Guide to protecting Your Business and its People*.
17. Regulatory Reform (Fire Safety) Order 2005, Fire (Scotland) Act 2005, Fire Safety (Scotland) Regulations 2006. Fire and Rescue Services (Northern Ireland) Order 2006.
18. RISCAuthority RE2 Need to Know Guide, *Lithium-ion battery use and storage*
19. Electricity at Work Regulations, 1989

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