

RC67: Recommendations for electrical safety in the event of fire

Includes interactive checklist

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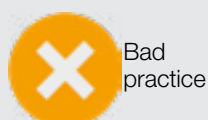
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Summary of Key Points

The table below summarises the key points of the document.

Comply with fire safety legislation	<ul style="list-style-type: none"> The responsible person must ensure that the premises and any facilities, equipment and devices provided for the use by or protection of firefighters are subject to a suitable system of maintenance and are maintained in efficient working order and good repair. This applies to electrical cut-off switches and similar provisions. Where the use of electrical equipment in a hazard zone identified as part of any assessment undertaken in compliance with the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR (as amended) is unavoidable, it should be suitably protected for the hazard zone in which it is to be used.
Fire safety management	<ul style="list-style-type: none"> Fixed wiring installations should be subject to periodic inspection and testing by a competent electrician in accordance with the requirements of BS 7671. All remedial actions identified in a periodic inspection report should be addressed in a timely manner.
General precautions	<ul style="list-style-type: none"> Where there is more than one electrical intake to a building, isolating one supply may not make all of the wiring within the building safe thus the locations of all consumer units should be indicated by a notice adjacent to each one of them.
Shutdown safety devices	<ul style="list-style-type: none"> Suitable automatic shutdown safety devices that operate without manual intervention when a fault occurs should be designed and installed prior to the commissioning of new plant or processes. Such systems should also operate to shut plant or processes down safely on activation of the fire alarm or automatic fire suppression system.
Firefighters' switches	<ul style="list-style-type: none"> A firefighters' switch should be provided in the low voltage circuit supplying exterior electrical installations and interior discharge lighting installations operating at a voltage exceeding low voltage. The switch should be installed in a conspicuous position that is accessible to firefighters and not more than 2.7m from the ground unless an alternative location has previously been agreed with the fire authority.
Photovoltaic installations (PV)	<ul style="list-style-type: none"> On each PV installation a switch should be provided in a prominent position readily accessible to firefighters to isolate the DC side of the PV system (a fire service switch) to ensure the safety of firefighting personnel. Operation of the switch should as a minimum make the DC side of the wiring inside the building voltage-free. The switch should be tested during routine maintenance visits, with the results being recorded.
High level cabling	<ul style="list-style-type: none"> Where electrical cables supplying power or lighting circuits; telephone, optical or data cabling are located at high level within a building, they should be carried on cable trays or be securely attached to the walls or ceiling using steel clips so as not to fall and present a hazard to fire service personnel affecting rescues or fighting a fire within the premises.
Generators	<ul style="list-style-type: none"> Generators are designed to cut-in and provide power on failure of the mains power supply and thus the presence and location of a generator linked to the mains supply for the premises should be made known to firefighters on their arrival.
Information for the fire and rescue service	<ul style="list-style-type: none"> Ensure that information is collated and provided for the fire service at a prominent location that describes the location of hazardous materials, electrical shutdown safety switches (including firefighters' switches), overhead power lines, generators and transformers plus information which describes the nature and location of safety systems such as fire alarm panels, sprinkler system controls and ventilation facilities.

Symbols used in this guide



1 Introduction

While the majority of RISCAuthority Recommendations are concerned with property protection and business continuity, this document is unusual in that it addresses life safety as well as property protection issues. In addition it is concerned not only with staff and visitors to the workplace but also to the safety of fire service personnel who may respond in the event of a fire. However, ensuring that appropriate safety measures are in place to protect firefighters will minimise any delays in commencing firefighting operations and contribute to avoiding the use of defensive firefighting tactics where firefighters fight the fire from outside, rather than within the premises. In this way this guidance does provide advice in order to minimise damage to property.

These recommendations have been produced in response to concerns regarding a number of issues, including the increased use of photovoltaic solar panels (PV panels), luminous tube signs and stand-by generators in the workplace. While firefighters' switches for fluorescent signs have been in common use for many years, emergency cut out switches and similar safety measures for other forms of power supplies, particularly those originating from PV panels which pose a potential threat to firefighters, are not in widespread use in a standardised form.

Although these recommendations provide protection for firefighters as well as for staff and visitors to the premises, it should be noted that the control of firefighters and firefighting operations is the responsibility of the fire and rescue service personnel controlling the fire ground and is thus outside the remit of the fire risk assessment for the premises undertaken by the Responsible Person.

2 Scope

These recommendations provide practical guidance to insurers and their clients regarding electrical hazards in the workplace and particularly those that may be encountered by firefighters responding to fire calls from commercial and industrial premises. The control measures are intended to minimise the risk of injury to personnel while reducing the potential for property losses and those associated with business continuity.

This document is not concerned with the generation of electrical power other than by photovoltaic panels and fixed and portable generators. Similarly, the recommendations are only concerned with the distribution of electricity within a single building or site.

The generation of static electricity and lightning protection are outside the scope of this publication; further information on the latter is set out in RISCAuthority Recommendations RC35 (ref. 1).

The management of portable electrical appliances (including PAT testing) and electric vehicles are also outside the scope of this document; Recommendations on these topics are set out in RISCAuthority Recommendations RC15 and RC59 respectively (refs. 2 and 3).

In addition to the above, recommendations regarding electrical aspects of safety in passenger and goods lifts are not included in this publication.

This document also provides advice concerning the provision of suitable fire extinguishers for life safety and property protection.

3 Synopsis

These recommendations provide advice concerning a range of issues where the design, installation and management of electrical systems could threaten the life safety of firefighters responding to a call from the premises. Chief among these are photovoltaic PV panel installations and luminous tube signs where provision should be made for the equipment to be made safe to allow effective firefighting operations. Uninterruptible power supply (UPS) systems and stand-by generators are also considered and information provided where electrical substations may be located within the boundaries of a commercial enterprise.

AC

Alternating current: electricity is delivered to business premises in the form of a current that follows a sinusoidal waveform that alternates from a positive to a negative value about 50 times a second.

Competent electrician

An electrician with suitable knowledge and experience appropriate for the type of installation and a member of a relevant professional body such as the National Inspection Council for Electrical Installations Contracting (NICEIC), the Electrical Contractors' Association (ECA), the National Association of Professional Inspectors and Testers (NAPIT), the Safety Assessment Federation (SAFed) or Select in Scotland.

DC

Direct current is a unidirectional flow of electricity and is commonly associated with batteries as well as photovoltaic panels. DC current presents a greater threat to life than AC current.

Low voltage

A voltage not exceeding:

- 1000 volts AC or 1500 volts DC if measured between any two conductors
- 600 volts AC or 900 volts DC if measured between a conductor and earth

Thermography

An infrared imaging technique whereby areas or components that are hotter than the ambient temperature appear brighter in a camera image, the brightness/colour of the image being proportional to the temperature of the area viewed.

UPS system

In simple terms a UPS system consists of a bank of batteries and capacitors together with power sensing and control circuitry which provides power to allow critical equipment, such as life support systems or computers, to keep running for at least a short time when the primary power source is lost. In some cases the UPS system may be online continuously to ensure a steady and clean (spike free) AC power supply even when the mains power supply is available. In this case it is recharged continuously by the mains supply. Alternatively a UPS system may be used as a back-up source to provide power automatically when the mains supply fluctuates inordinately or for the few seconds between failure of the mains power supply and the cutting-in of a stand-by generator.

5.1 Compliance with fire safety legislation

- 5.1.1 A suitable and sufficient fire risk assessment should be undertaken for all premises to which the Regulatory Reform (Fire Safety) Order 2005 (or equivalent legislation in Scotland and Northern Ireland) applies (refs. 4-8).
- 5.1.2 Fire risk assessments should be subject to periodic review; the review should consider the processes carried out at the premises in conjunction with the number, alertness and mobility of the persons within the building.
- 5.1.3 There is a requirement under Article 38 of the Regulatory Reform (Fire Safety) Order for England and Wales (Article 23 in the case of the equivalent legislation in both Scotland and Northern Ireland) that requires that where necessary in order



Where necessary in order to safeguard the safety of firefighters in the event of a fire, the responsible person must ensure that the premises and any facilities, equipment and devices provided in respect of the premises for the use by or protection of firefighters are subject to a suitable system of maintenance and are maintained in efficient working order and good repair. This applies to electrical cut-off switches and similar provisions. (5.1.3)

to safeguard the safety of firefighters in the event of a fire, the responsible person must ensure that the premises and any facilities, equipment and devices provided in respect of the premises for the use by or protection of firefighters are subject to a suitable system of maintenance and are maintained in efficient working order and good repair. This applies to electrical cut-off switches and similar provisions. (See RC 66: ref. 23.)

- 5.1.4 The design and location of an electrical cut-off switch should be compatible with the hazard zones identified as part of any assessment undertaken in compliance with the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR (as amended)) (ref. 9). DSEAR assessments should be undertaken by a competent person.
- 5.1.5 The response by fire and rescue services to 999/112 calls and signals routed via fire alarm monitoring organisations varies widely throughout the UK, and differs from day to night-time. Fire safety managers should refer to the relevant fire and rescue service to make themselves aware of the levels of response in the areas in which their premises are located and consider this information when undertaking and reviewing their fire risk assessments.

5.2 Business continuity

- 5.2.1 Even a small fire can have a disproportionate effect on a business if it occurs in a critical area. The provision of appropriate electrical isolation switches and similar provisions may assist firefighting operations and avoid a fire developing to cause unnecessary disruption to the efficient functioning of the business.
- 5.2.2 All businesses should take steps to maintain the continuity of their operations by making a suitable emergency plan. Guidance for this is set out in Business Resilience: A guide to protecting your business and its people (ref. 10). The emergency plan should address the implications of a fire, flood or other perceived disaster on all facets of the business model. It should indicate the lines of communication that should be followed and the contact details for specialist assistance, providers of alternative accommodation and suppliers of replacement equipment.
- 5.2.3 Tabletop exercises should be held periodically to test the effectiveness and suitability of the emergency plans.
- 5.2.4 Consideration may be given to applying commercially available computer programs, such as the ROBUST software (Resilient Business Software Toolkit) that is available free of charge (ref. 11), or similar product, to develop and check the adequacy of the plan.

5.3 Fire safety management

- 5.3.1 Fixed wiring installations should be designed and installed in compliance with BS 7671 (ref. 12). They should be maintained by a competent electrician in accordance with the periodic inspection certificate. All remedial actions identified in a periodic inspection report should be addressed in a timely manner.
- 5.3.2 Where new premises are being planned, the location of the electrical intake and consumer units should receive careful consideration. In all cases consumer units should be readily accessible by fire and rescue service personnel to allow the supply to be isolated if necessary to ensure safe working by firefighters.
- 5.3.3 Although needing to be accessible to fire service personnel electrical consumer units should not, wherever possible, be sited on escape routes or within under stair cupboards. Cabling and associated safety systems should be appropriately labeled in accordance with BS 7671 (ref. 10) and consumer units and control panels and the like fitted with signs that ease their identification in the event of an emergency.
- 5.3.4 In all premises the electrical consumer units should be located in an enclosure that will provide at least 30 minutes fire resistance. The doors to the enclosure should be to the same standard and carry signs that indicate their content so as to be identifiable by the fire and rescue service.



Electrical consumer units should be sited in positions that are accessible to fire service personnel but wherever possible not on escape routes or within under stair cupboards. (5.3.3)



Where there is more than one electrical intake to a building, isolating one supply may not make all of the wiring within the building safe. (5.3.6)

- 5.3.5 The enclosure containing the electrical consumer units should be kept free of stored materials. Where the consumer units are located within a large cupboard or room, other parts of the area may be used for storage provided that the consumer units are within a 30 minute fire resistance enclosure within the cupboard or room, and an area within at least 500mm of the enclosure is kept free of storage to minimise the potential for ignition of a ready source of fuel and allow access to the electrical installation.
- 5.3.6 Where there is more than one electrical intake to a building, isolating one supply may not make all of the wiring within the building safe thus the locations of all consumer units should be indicated by a notice adjacent to each one of them.
- 5.3.7 The locations of the electrical consumer units / isolation switches should be included in the information provided for the fire service on their arrival at the premises.
- 5.3.8 In 2004 the colour conventions for the insulation on the conductors of three phase electrical supplies changed so as to harmonise with those of other European countries (see Figure 1). This has serious safety implications, thus where modifications are made to older circuits a notice should be displayed conspicuously on all consumer units warning that two colour conventions are used in the installation.

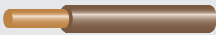



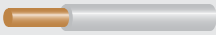







Function	UK (new code as per IEC)	UK (old code)
Three phase line (L1)		
Three phase line (L2)		
Three phase line (L3)		
Neutral (N)		
Positive earth or ground (PE)		
Single phase live		

Figure 1: Old and new colours for three phase cables – note implications of new allocation for blue and black cables



What are the benefits of having a thermographic inspection of our electrical panels? (5.3.9)

- 5.3.9 Planned maintenance programmes for industrial and commercial facilities should include periodic thermographic surveys of electrical consumer units and control boxes to allow incipient electrical faults to be identified and remedied before they result in a fire. Thermographic surveys should be carried out by a competent person.
- 5.3.10 The installation should be designed so that failure of mains power will result in:
- doors on fire escape routes held shut with electromagnets being released (where compatible with the security of the premises)
 - sliding doors failing safe in the open position
 - the isolation of gas and electrical supplies to cooking equipment and boilers
 - the provision of power by UPS systems and stand-by generators (see sections 5.5 and 5.6)
- 5.3.11 Where necessary cables and control boxes should be protected against attack by rodents.

Large sites

- 5.3.12 At large sites arrangements should be made to provide prompt access for the fire and rescue service on their arrival. Firefighters should be met by security personnel or another designated member of staff who should have gates or barriers already open.
- 5.3.13 A clear route should be maintained to allow high reach vehicles and pumping appliances to gain suitable access to all relevant parts of the site and suitable turning places should be available as set out in Approved Document B to the Building Regulations (ref 13) and guidance supporting equivalent legislation in Scotland and Northern Ireland (refs 14 and 15). Where necessary, liaison should be established with the fire and rescue service. (See 5.3.15 regarding overhead cables.)



A clear route should be maintained to allow high reach vehicles and pumping appliances to gain suitable access to all relevant parts of the site. (5.3.13)



How best can we provide the information that the fire and rescue service require on their arrival? (5.3.14)

- 5.3.14 Information should be provided for the fire and rescue service at a prominent location, such as the gatehouse, to include:
- the layout of the site, including plans of large buildings showing the locations of PV panels and control equipment (PV panels are not always visible from ground level)
 - the location of any electrical transformers and/or sub-stations on site that are operated by the company or the electrical utilities
 - the location of overhead power lines
 - electric vehicle charging points
 - the nature and location of any hazardous substances on the premises
 - the location of the main electrical intake(s) and consumer units
 - the location of isolation switches for PV panels
 - the location of the indicator panel for the automatic fire detection and alarm installation
 - details of any automatic fire suppression system(s) and the location of their controls or valves
 - the location of hydrants, rising mains or other sources of water on site or nearby for firefighting purposes
 - details of ventilation systems
 - contact details for staff who may need to be consulted

Overhead cables

- 5.3.15 Where electrical cables supplying power or lighting circuits are located at high level within a building, they should be carried on cable trays, ladder racks etc or be securely attached to the walls or ceiling using steel clips so as to prevent their premature collapse, and present a hazard to fire service personnel affecting rescues or fighting a fire within the premises.
- 5.3.16 The guidance set out in paragraph 5.3.15 should also be observed when installing telephone, optical and data cables.
- 5.3.17 Trees on commercial and industrial sites should not be allowed to grow too near to overhead power cables. Where trees appear to be near power lines no attempt should be made to engage a contractor or tree surgeon to climb the tree to make a close inspection or prune the branches. Advice should be sought from the National Grid who will provide details of the local electricity operator for the area.
- 5.3.18 Most overhead wiring is carried out by electricity supply companies. There are occasions, however, when wiring between buildings is necessary and can be supplied via a short catenary system. The installation should employ a suitable cable and either be run in conduit or supported by catenary wire (some specialist cables are available with integral catenary wire). Catenaries should be installed in accordance with BS 7671 (ref. 15) but in all cases they should be located at least 5.2m above any area through which fire service vehicles may need to pass. Catenaries should be installed by competent electricians.
- 5.3.19 Information should be provided for firefighters to indicate the operating voltage of any overhead cable or catenary system on the site. Unless the fire and rescue service can be positively assured that the cable operates at low voltage, they will have to assume it to be high voltage as a result of which no person, ladder or aerial appliance may come within 10m of the cable (see Figure 5).

Underground cables

- 5.3.20 Locations of underground cables should be recorded together with the locations of other buried services and copies of the plans passed to builders, contractors or utility workers who are intending to make excavations.



Where electrical cables supplying power or lighting circuits are located at high level within a building they should be carried on cable trays or be securely attached to the walls or ceiling using steel clips so as not to fall and present a hazard to fire service personnel. (5.3.15)



Trees on commercial and industrial sites should not be allowed to grow too near to overhead power cables. (5.3.17)



What forms of automatic shutdown safety devices could be fitted on our processes? (5.3.21)



Where equipment is powered by a three phase supply, the emergency switch should interrupt all live conductors. (5.3.24)



Devices for emergency switching should be readily accessible and clearly marked. (5.3.26)



Wherever practicable the use of electrical equipment should be avoided in hazard zones identified in an assessment carried out in compliance with the DSEAR Regulations (5.3.33)



A firefighters' switch should be provided for exterior discharge lighting installations operating at a voltage exceeding low voltage. A switch should also be installed for interior discharge lighting installations operating unattended at a voltage exceeding low voltage (5.4.1)

Isolation of industrial processes

- 5.3.21 Wherever practicable suitable automatic shutdown safety devices that operate without manual intervention when a fault occurs should be designed and installed prior to the commissioning of new plant or processes. Such systems should also operate to shut plant or processes down safely on activation of the fire alarm or automatic fire suppression system.
- 5.3.22 When staff evacuate a building in the event of fire, industrial processes, especially those utilising an electrical supply to produce heat or movement, should be isolated from the supply if possible as staff leave the premises.
- 5.3.23 In all cases measures should be available to rapidly disconnect electric equipment that may present a hazard to firefighters or staff evacuating the premises. The switching, which may take the form of an emergency switch or the functional switch used during normal operations, should be designed to act as directly as possible to isolate the supply conductors and wherever possible be operated as a single action.
- 5.3.24 Where equipment is powered by a three phase supply, the emergency switch should interrupt all live conductors. (Special electrical provisions will be necessary in the case of a four wire three phase circuit.)
- 5.3.25 Providing that relevant electrical safety conditions are observed, a group of circuits may be isolated by a single device.
- 5.3.26 Devices for emergency switching should be readily accessible and clearly marked.
- 5.3.27 Emergency isolation should normally be undertaken by the operator or person in charge of the machine or equipment.
- 5.3.28 Where skilled or specially trained personnel are required to shut down a process safely (for example where incorrect shut down may produce a greater hazard to firefighters or others than leaving the equipment operating) the procedure should be undertaken by designated trained staff and be addressed in the emergency plans for the area. The strategy should be rehearsed during periodic fire drills.
- 5.3.29 Emergency switches for industrial equipment and processes should be located where they may be readily accessed in a foreseeable emergency, and where practicable adjacent to escape routes.
- 5.3.30 Domestic style cookers should be controlled by a switch separate from the appliance and located within 2m of the equipment. It should not be necessary to lean over the cooker to reach the switch.
- 5.3.31 All emergency isolators or switches should be installed by a competent electrician.
- 5.3.32 Portable electrical equipment and static devices powered by a conventional plug and socket are not required to be fitted with emergency switches.

Explosive atmospheres

- 5.3.33 Wherever practicable the use of electrical equipment should be avoided in hazard zones identified in an assessment carried out in compliance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 (as amended).
- 5.3.34 Where the use of electrical equipment in a hazard zone is unavoidable, it should be suitably protected for the zone in which it is to be used. The equipment should be inspected and maintained as set out in BS EN 60079-17 (ref. 16).
- 5.3.35 Where testing, service and maintenance work has to be undertaken on electrical equipment installed in a hazard zone (such as on petrol pumps) a risk assessment should be carried out and appropriate measures (such as isolating the electric power to the pumps) undertaken before work commences.

5.4 Luminous tube signs

- 5.4.1 Firefighters' switches for luminous tube signs operating in excess of 'low voltage' (see definitions) are specifically addressed in respect of England and Wales in Article 37 of the Regulatory Reform (Fire Safety) Order 2005 (but notably not in the equivalent legislation in Scotland and Northern Ireland).

FAQ

Why do firefighters' switches have to be provided for exterior discharge lighting installations but not for other forms of exterior lighting? (5.4.1)

FAQ

Why does a firefighters' switch have the off position at the top? (5.4.9)



Figure 2: Firefighter's switch which locks in the off position



Figure 3: Sign indicating the location of a firefighter's switch

A firefighters' switch should be provided for exterior discharge lighting installations operating at a voltage exceeding low voltage. A switch should also be installed for interior discharge lighting installations operating unattended at a voltage exceeding low voltage.

This requirement does not apply in respect of:

- existing or proposed installations in premises to which a licence under the Licensing Act 2003 (ref. 17) has effect, authorising the use of premises for the exhibition of a film, i.e. cinemas and like premises
- a portable discharge lighting luminaire or sign of a rating not exceeding 100W and fed from a readily accessible socket outlet

- 5.4.2 The switch should be installed to isolate the electrical supply on the input (lower) voltage side of the transformer.
- 5.4.3 In England and Wales the Responsible Person for the premises (as defined in the Regulatory Reform (Fire Safety) Order 2005) should commence liaising with the fire authority at an early time as possible, at least 42 days in advance of installation of the apparatus. In the case of new installations the Responsible Person is required to give notice of the location, colouring and marking of the cut-off switch. Where the authority is not satisfied with the location or colour they must respond within 21 days with their reasons.
- 5.4.4 For an exterior installation the switch should be located outside the building and adjacent to the equipment. Alternatively, a notice indicating the position of the switch should be placed adjacent to the equipment. In the latter case a nameplate should be fixed near the switch indicating its purpose.

Wherever practicable all exterior installations on any one building should be controlled by a single firefighters' switch. Where more than one firefighters' switch is necessary the parts of the installation which each switch controls should be clearly marked and the arrangements should be agreed with the fire authority prior to installation.

- 5.4.5 For an interior installation the switch should be in the main entrance to the building so as to be available to the firefighters on their arrival. Alternatively it may be at some other position as agreed with the fire authority prior to installation.
- As for the case of external lighting, internal installations should also be controlled by a single firefighters' switch and this switch should be independent of the switch for any external installation.
- 5.4.6 The switch shall be installed in a conspicuous position that is accessible to firefighters and not more than 2.7m from the ground unless an alternative location has previously been agreed with the fire authority.
- 5.4.7 Where more than one switch is installed on any one building, each switch shall be clearly marked to indicate the installation or part of the installation that it controls.
- 5.4.8 The switch should be coloured red and have fixed on or near it a durable sign at least 150mm x 100mm marked with the words 'FIREFIGHTERS SWITCH' or 'FIREMAN'S SWITCH'.
- 5.4.9 The switch should have its ON and OFF positions clearly marked with the 'OFF' position at the top.
- 5.4.10 It should be provided with a device to prevent the switch being inadvertently returned to the 'ON' position.

5.5 UPS systems

- 5.5.1 UPS systems must be kept fully charged to maintain their effectiveness in an emergency.
- 5.5.2 It is vital that in healthcare premises procedures are in place for effective liaison between senior healthcare staff and the fire service on their arrival to ensure that a UPS or generator power supply is not isolated until theatre procedures have been completed or portable life support equipment is in position.
- 5.5.3 No attempt should be made to de-energise a UPS system in the event of fire.



Under what circumstances is a stand-by generator a hazard to firefighters? (5.6.3)

5.6 Stand-by generators

- 5.6.1 Generators may be fixed installations installed to provide continuity of power to business critical areas (such as patient areas in hospitals) or take the form of emergency power supplies, normally in pods, transported by truck to the site to provide power for a particular purpose or project. Transportable generators may, for example, be used for the supply of power in remote areas where a permanent link to the National Grid may not be necessary or not financially viable. In all cases the power supply must be designed, installed and maintained in accordance with the manufacturer's recommendations.
- 5.6.2 Generators, which are normally fuelled by diesel fuel, LPG or natural gas, should be provided with suitable control systems and circuit breakers, the location of which should be prominently signed for use by the fire service personnel in an emergency.
- 5.6.3 Generators are designed to cut-in and provide power on failure of the mains power supply and thus the presence and location of a generator linked to the mains supply for the premises should be made known to responding firefighters on their arrival. The strategy for the use of the generator should be included in the emergency plans for the premises.
- 5.6.4 Company engineering staff should be available to liaise with firefighters and assist in shutting down a generator where necessary. Notices should be displayed prominently in the generator room giving contact details for appropriate staff. This is particularly important where large or complex generating sets (such as combustion turbine units) are in use.

Portable generators

- 5.6.5 Portable generators provide limited power and should only be provided for a specific purpose such as to power a stand-alone piece of equipment.
- 5.6.6 The output from a portable generator should not be linked to the main electrical installation for a building or site.
- 5.6.7 Portable generators should normally be located outside the premises or in a well ventilated location where they may be readily accessed by firefighters in an emergency.

5.7 Other battery powered supplies

- 5.7.1 The increasing power capacity of batteries has led to a corresponding increase in the fire hazards associated with their use. The increasing number of high power battery packs in use, for example in vehicles, and the need for the storage of back up and spare units presents a potential threat and should be addressed in the fire risk assessment of relevant premises.
- 5.7.2 Fire hazards can arise as a result of accidents such as crushing (for example discarding batteries in compactors), incinerating, overheating while charging, and a short circuit of a battery or associated wiring. All batteries should be stored and handled in accordance with the manufacturers' instructions and special care should be taken regarding their disposal. Further guidance is set out in RISCAuthority Recommendations RC61 (ref. 18).
- 5.7.3 Particular care should be taken with lithium ion and lithium polymer batteries which have been recorded as being involved in a number of fires. Lithium ion batteries can rupture, ignite or explode:
- when exposed to high temperature environments, for example exposure to direct sunlight
 - when short circuited
 - when incorrectly charged
 - when an attempt is made to open or modify the battery casing or circuitry
 - if the safety devices that protect the cells suffer abuse or damage



The use of lithium polymer batteries should be avoided where possible; where their use is unavoidable their number should be minimised. (5.7.4)

If one cell ignites, adjacent cells can catch light with increasing ferocity. Consideration could be given to removing the battery from a laptop or notebook computer which is to run from mains power for a prolonged period of time so that it is not affected by the heat produced by the appliance.

- 5.7.4 Lithium polymer batteries can be extremely hazardous; an explosion or fire may result as a result of short circuiting the battery or overcharging the pack. Where the battery pack is formed of multiple cells there can be a chain reaction with a significant period of time between the involvement of adjacent cells, but with each successive fire or explosion being more intense than the previous event.

The temperatures reached in these fires can be in excess of 1000°C. Fires in small cells can be tackled using dry powder extinguishers but, because of their lithium content, fires in large batteries can be difficult and hazardous to extinguish. Special Class D dry powder fire extinguishers may be needed for large batteries and where significant quantities of smaller batteries are located.

The use of lithium polymer batteries should be avoided where possible; in other cases their number should be minimised.

- 5.7.5 Areas used for the storage of lithium ion and lithium polymer batteries should be prominently labeled for the information of firefighters.

5.8 Photovoltaic panel installations

There have been a number of fires where concerns have been raised by firefighters regarding electrical safety when applying water onto burning roofs that are carrying PV panels. These worries could result in defensive firefighting tactics being employed whereby the fire is prevented from spreading to nearby properties rather than being extinguished at its source. This could potentially result in significant increases in property losses.

- 5.8.1 Where PV panels are installed on roofs or in ground arrays the electrical installation should comply with the IET Code of Practice for Grid Connected Solar Photovoltaic systems (ref. 19) and the guidance provided in RC62: Recommendations for fire safety with photovoltaic panel installations (ref. 20) should be observed.
- 5.8.2 When designing the physical layout of a PV array upon a roof, consideration needs to be given to access routes for firefighters and escape routes for occupants:
- for pitched roofs, a border free of panels around the array should be considered. Arrays should also be kept away from roof eaves and ridges to permit ladder access
 - for flat roofs, PV arrays need to permit access around the roof (larger systems may need the inclusion of access corridors) and arrays need to be kept away from any fire escape routes
- 5.8.3 The presence of a PV system on a building is not always obvious from ground level, thus a sign that indicates the presence of a PV system on a building or structure should be prominently displayed for the information of the fire and rescue service. The sign, measuring at least 100mm x 100mm shown in Figure 4 should be displayed at the consumer units or supplier's cut out.
- 5.8.4 In addition to the sign illustrated in Figure 4 prominent notices must be displayed on the DC side of the installation warning that components may still be live even after disconnection from the current converter.
- 5.8.5 On each installation a switch should be provided in a prominent position readily accessible to firefighters to isolate the DC side of the PV system (a fire service switch) to ensure the safety of firefighting personnel. Operation of the switch should as a minimum make the DC side of the wiring inside the building voltage-free. The switch should be tested during routine maintenance visits, with the results being recorded.
- 5.8.6 As well as operating the fire service switch, fire service personnel should also disconnect the PV installation from the mains electricity within the building.
- 5.8.7 Fire and rescue service personnel should be aware that PV panels produce DC current from daylight and other light sources, including any floodlights used to

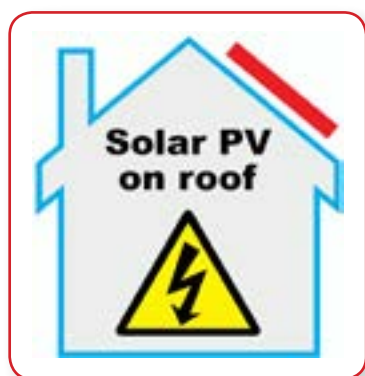


Figure 4: Where solar panels are installed on a building or structure a sign should be displayed (see 5.8.3)

illuminate the fire ground, even if the AC side of the circuit is isolated from the mains electrical supply. This continuing production of DC voltage may have to be addressed in the fire and rescue service risk assessment undertaken before firefighting commences. At present there are many installations where a fire service switch is not provided.

Ground mounted PV systems

- 5.8.8 Care should be taken when designing large free-standing arrays. The land selected should be away from public footpaths, not be prone to flooding in poor weather and not be made available for grazing animals or commercial crops. At the same time, the site should be accessible by fire service vehicles.
- 5.8.9 Access and the locations of isolation points for the arrays should be discussed with the fire and rescue service at the planning stage.
- 5.8.10 In the case of large installations, firefighters should be invited to visit the premises to familiarise themselves with the property, including the locations of the isolation points for the PV panels.
- 5.8.11 On open sites undergrowth should be controlled manually, by the planting of specially selected grasses or by the use of non-chlorate based weed killers.

5.9 Transformers, substations and power lines

- 5.9.1 Where there is an electricity substation within the confines of an industrial or commercial site or integral to a building on the site, the Responsible Person should take cognisance in their fire risk assessment that the fire and rescue service will not be able to enter the enclosure or fight a fire in the transformer or substation (which may be operating at voltages between 6,600V and 400,000V) until they have received confirmation from the Authorised Person of the electricity company that it is safe to do so. In these cases there may well be a delay in commencing firefighting operations. In some cases there may also be a delay while firefighters ensure that sufficient stocks of controlling media are available for a sustainable firefighting operation.
- 5.9.2 Where overhead power lines pass over an industrial or commercial site the management should be aware that firefighters may not direct high pressure jets across roofs because:
 - there may be a danger of the jet coming into contact with power lines causing them to move towards each and arcing occurring. This may result in a live conductor breaking and falling to the ground
 - a water jet played directly onto an overhead conductor may result in earth leakage through the jet making the firefighter's branch live with fatal consequences

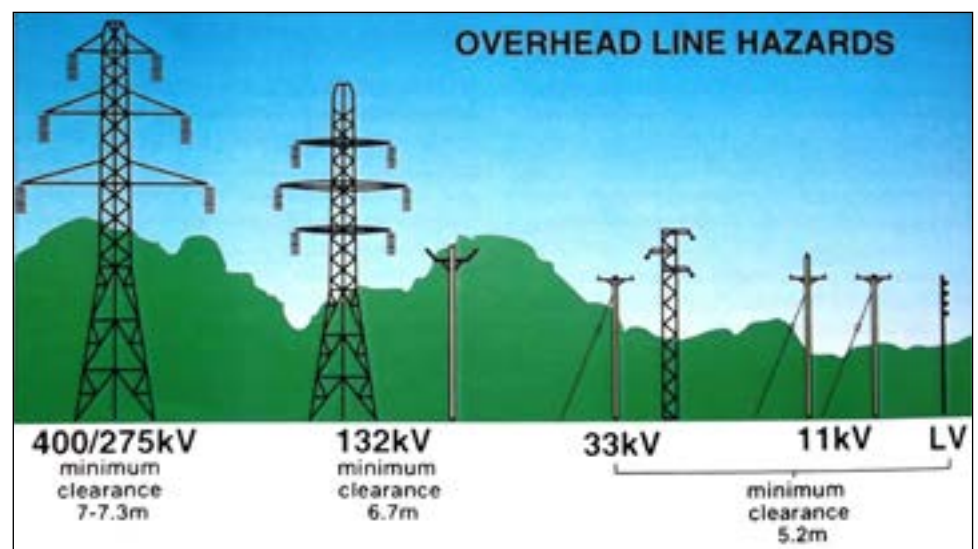


Figure 5: Overhead line hazards: transmission towers (pylons), poles and cables – minimum ground clearances (From: Fire Service Manual Vol 2)

- 5.9.3 Unobstructed access should be maintained at all times to allow fire and rescue service and electricity company access to any transformer or substation within the confines of the site.

5.10 Fire protection

- 5.10.1 The fire brigade should be called to all fires as soon as practicable.
- 5.10.2 An appropriate number of suitable fire extinguishers should be provided throughout the premises. All such extinguishers should be approved and certificated by an independent, third-party accredited certification body. The extinguishers should be provided in easily accessible positions, normally on escape routes, as set out in BS 5306-8 Fire extinguishing installations and equipment on premises. Selection and installation of portable fire extinguishers. Code of Practice (ref. 21).
- 5.10.3 Fire extinguishers should be serviced and maintained in accordance with BS 5306-3: Fire extinguishing installations and equipment on premises. Commissioning and maintenance of portable fire extinguishers. Code of Practice (ref. 22).
- 5.10.4 It is important that there is a sufficient provision of extinguishers suitable for use on fires involving electrical equipment. In most cases carbon dioxide extinguishers should be provided. Dry powder extinguishers are not now generally recommended for use within buildings due to the possibility of the cloud of powder obscuring a view of the escape route, health hazards of ingesting the powder and the corrosive effects of the extinguishing agent on electronic and precision equipment. Dry powder extinguishers may, however, be appropriate for use in an external environment following a specific risk assessment.
- 5.10.5 A number of designated staff should be trained in the use of the fire extinguishers provided. The training should include the safe use of water based extinguishers (including spray foam units) which should not be directed towards electrical equipment or wiring unless it is known that the electrical power has been isolated and they are not connected to a UPS system. Ideally, this training should be practical in nature.

6 Checklist

This checklist is based on the guidance and certain recommendations made in RC67: *Recommendations for electrical safety in the event of fire* and designed for use by premises operators and in particular members of the maintenance or facilities team as an audit tool for use on site.

The Checklist can be printed and a hard copy used, or completed electronically and printed off (if needed); checklists created electronically will be saved with the document on closing as a digital record. The references with each question below and shown in brackets relate to the relevant sections of RC67.

Additional blank copies of the checklist may be created as required for printing or electronic completion.

Premises

Location/area

Date

Time

Inspection undertaken by

			Action required	Due date	Sign on completion
6.1	Fire safety management (section 5. 3)				
6.1.1	Are fixed wiring installations maintained by a competent electrician in accordance with BS 7671 and associated periodic inspection certificate? (5.3.1)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A			
6.1.2	Are cables and associated safety systems labeled in accordance with BS 7671 and consumer units/ distribution boards provided with signs that ease their identification in the event of an emergency?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A			
6.1.3	Are electrical consumer units sited in positions that are accessible to fire service personnel but away from escape routes and not in under stair cupboards? (5.3.3)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A			
6.1.4	Are the electrical consumer units located in an enclosure that will provide at least 30 minutes fire resistance? (5.3.4)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A			
6.1.5	Is the enclosure containing the electrical consumer units kept free of stored materials? (5.3.5)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A			

Action required			Due date	Sign on completion
6.1.6	Where there is more than one electrical intake to a building are the locations of all consumer units indicated by a notice adjacent to each one of them? (5.3.6)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.7	Are the locations of the electrical consumer units / isolation switches included in the information provided for the fire service on their arrival at the premises? (5.3.7)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.8	Where modifications have been made to older circuits is a notice displayed conspicuously on all consumer units where appropriate warning that two colour conventions are used in the installation? (5.3.8)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.9	Do planned maintenance programmes include periodic thermographic surveys of electrical consumer units and control boxes to allow incipient electrical faults to be identified and remedied before they result in a fire? (5.3.9)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.10	Does failure of mains power result in the release of doors on escape routes, sliding doors failing safe in the open position and the isolation of gas and electrical supplies to cooking equipment and boilers? (5.3.10)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.11	Where necessary are cables and control boxes protected against attack by rodents? (5.3.11)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.12	At large sites are arrangements made to provide prompt access for the fire and rescue service on their arrival? (5.3.12)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.13	Is a clear route maintained to allow high reach vehicles and pumping appliances to gain suitable access to all relevant parts of the site? (5.3.13)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.14	Does information provided for the fire and rescue service include the layout and location (where applicable) of PV panels and isolation switches, any electrical transformers and/or sub-stations on site, overhead power lines and the main electrical intake(s) and consumer units? (5.3.14)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		

Action required			Due date	Sign on completion
6.1.15	Where electrical, optical and data cables are located at high level within a building are they carried on cable trays or securely attached to the walls or ceiling using steel clips? (5.3.15)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.16	Do catenary installations employ a suitable cable and either be run in conduit or supported by catenary wire? (6.3.18)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.17	Are catenary supplies installed in accordance with BS 7671? (5.3.18)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.18	Is information provided for firefighters to indicate the operating voltage of any overhead cable or catenary system on the site? (5.3.19)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.19	Are measures available to rapidly disconnect electric equipment that may present a hazard to firefighters or staff evacuating the premises? (5.3.23)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.20	Where equipment is powered by a three phase supply, do the emergency switch(es) interrupt all live conductors? (5.3.24)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.21	Are relevant electrical safety conditions observed where a group of circuits may be isolated by a single device? (5.3.25)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.22	Are devices for emergency switching readily accessible and clearly marked? (5.3.26)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.1.23	Are emergency switches for industrial equipment and processes located where they may be readily accessed in a foreseeable emergency and where practicable adjacent to escape routes? (5.3.29)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		

Action required			Due date	Sign on completion
6.1.24	Are domestic style cookers controlled by a switch separate from the appliance and located within 2m of the equipment? (5.3.30)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2 Luminous tube signs (section 5. 4)				
6.2.1	Is a firefighters' switch provided for exterior discharge lighting installations operating at a voltage exceeding low voltage? (5.4.1)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2.2	Is the switch installed to isolate the electrical supply on the input (lower) voltage side of the transformer? (5.4.2)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2.3	For an exterior installation is the switch located outside the building and adjacent to the equipment? (5.4.4)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2.4	For an interior installation is the switch in the main entrance to the building so as to be available to the firefighters on their arrival? (5.4.5)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2.5	Is the switch installed in a conspicuous position that is accessible to firefighters and not more than 2.7m from the ground? (5.4.6)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2.6	Where more than one switch is installed on any one building, is each switch clearly marked to indicate the installation or part of the installation that it controls? (5.4.7)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2.7	Is the switch coloured red and have fixed on or near it a durable sign at least 150mm x 100mm marked with the words 'FIREFIGHTERS SWITCH' or 'FIREMAN'S SWITCH'? (5.4.8)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.2.8	Does the switch have its ON and OFF positions clearly marked with the 'OFF' position at the top? (5.4.9)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		

Action required			Due date	Sign on completion
6.2.9	Is the switch provided with a device to prevent the switch being inadvertently returned to the 'ON' position? (5.4.10)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.3 Stand-by generators (section 5.6)				
6.3.1	Are generators provided with suitable control systems and circuit breakers, the location of which are prominently signed for use by the fire service personnel in an emergency? (5.6.2)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.3.2	Is the output from a portable generator never linked to the main electrical installation for a building or site? (5.6.6)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.3.3	Are portable generators located outside the premises or in a well ventilated location where they may be readily accessed by firefighters in an emergency? (5.6.7)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.4 Other battery powered supplies (section 5.7)				
6.4.1	Are areas used for the storage of lithium ion and lithium polymer batteries prominently labeled for the information of firefighters? (5.7.5)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.5 Photovoltaic panel installations (section 5.8)				
6.5.1	Where PV arrays are sited on a roof, have access routes for firefighters and escape routes for occupants, by way of a border free of panels, been maintained? (5.8.2)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.5.2	As the presence of a PV system on a building is not always obvious from ground level, is a sign that indicates the presence of a PV system on a building or structure prominently displayed for the information of the fire and rescue service? (5.8.3)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.5.3	In addition to the sign are prominent notices displayed on the DC side of the installation warning that components may still be live even after disconnection from the current converter? (5.8.4)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		

Action required			Due date	Sign on completion
6.5.4	Is an isolation switch provided on each installation in a prominent position readily accessible to firefighters to isolate the DC side of the PV to ensure the safety of firefighting personnel? (5.8.5)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.6 Transformers, substations and power lines (section 5.9)				
6.6.1	Is unobstructed access maintained at all to times to allow fire and rescue service and electricity company access to any transformer or substation within the confines of the site? (5.9.3)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		
6.7 Fire protection (section 5.10)				
6.7.1	Are fire extinguishers serviced and maintained in accordance with BS 5306-3? (5.10.3)	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A		

7 References

1. RC35: Recommendations for the protection of buildings against lightning strike, 2013, Fire Protection Association.
2. RC59: Recommendations for fire safety when charging electric vehicles, 2012, Fire Protection Association.
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