Recommendations

RC37

for the control of fire hazards arising from electrical lighting in commercial and industrial premises

FPA
Fire Protection Association

InFiReS

LOSS PREVENTION RECOMMENDATIONS

These Recommendations are part of a series of insurer documents developed under the Insurers' Fire Research Strategy Funding Scheme (InFiReS) and published by the FPA. InFiReS 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 property and business from loss due to fire and other risks. The technical expertise for the Recommendations is provided by the Technical Directorate of the FPA and experts from the insurance industry who together forms the InFiReS Process Steering Group.

The aim of the FPA Series of Recommendations is to provide loss prevention guidance for industrial and commercial processes and systems. The series continues a long tradition of providing authoritative guidance on loss prevention issues started by the Fire Offices' Committee (FOC) of the British insurance industry over a hundred years ago and builds upon earlier publications from the LPC and the ABI.

Lists of other publications on loss control including other documents in the RC series are available at www.thefpa.co.uk and from the FPA at London Road, Moreton-in-Marsh, Gloucestershire GL56 0RH. Copies of publications can be purchased from the FPA at this address or by calling 01608 812500 or e-mailing sales@thefpa.co.uk.

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SCOPE

This publication aims to outline practical measures that can be taken to reduce the number of fires caused by artificial lighting and mitigate the losses associated with these incidents. The guidance relates to portable as well as fixed lighting but does not extend to emergency escape lighting, way-finding installations or lighting for use in hazardous environments.

INTRODUCTION

Lighting is a feature of buildings which is often designed to be unobtrusive and unnoticed. As it is ever present, it tends to be forgotten and, with familiarity, may even be treated, perhaps not with contempt, but without thought. It may come as a surprise, therefore, that the *UK Fire Statistics* record lighting as a significant cause of fire in industry and commerce.

Statistics relating to the incidence of fires in the UK are published annually by the Office of the Deputy Prime Minister (ODPM).

Every year there are about 800 fires caused by electric lighting. Chart 1 shows the precise causes of these fires in more detail.

During recent years there has been an increase in the number of fires resulting from articles being placed too close to lights, which acted as sources of ignition.

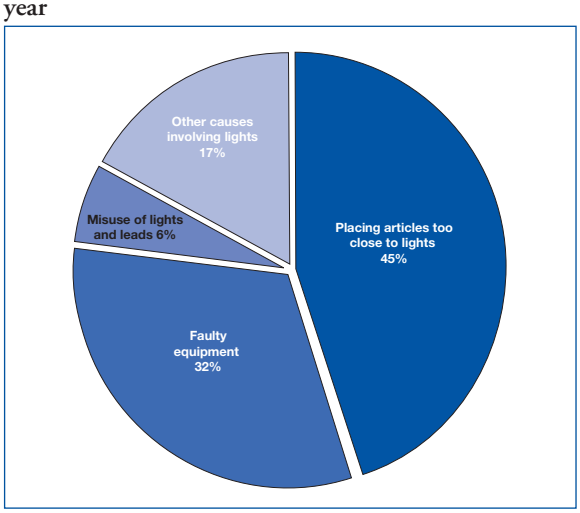
For the period 1994 to 2001 the FPA large loss fires database recorded 78 fires with losses over £50,000 that were caused by lighting. These resulted in a total direct loss of nearly £66m, nearly £10m annually. In addition, there were many hundreds of smaller fires that together also led to significant financial loss.

RECOMMENDATIONS

1 Definitions

1.1 *Ballast:* electronic components used to control the electrical frequency of fluorescent lamp operation.

Chart 1. Fires caused by electric lighting in a typical year



1.2 *Colour temperature*: a description of the colour quality of a light source, in terms of warmth or coolness, using as a reference source a perfect black body at the stated temperature, measured at absolute temperature (kelvins (K)).

1.3 *Earthed equipotential zone:* a zone in which exposed conductive parts and extraneous conductive parts are maintained at substantially the same potential by bonding to prevent electric shock under fault conditions.

1.4 *Extra low voltage:* a voltage not exceeding 50V ac or 120V dc whether between conductors or to earth.

1.5 *Low voltage:* greater than extra low voltage but less than 1000V ac or 1500V dc between conductors, or 600V ac or 900V dc between conductors and earth.

1.6 *Luminaire support coupler:* a socket outlet and a plug providing mechanical support for a luminaire and the electrical connection to and from a fixed wiring installation.

1.7 *Residual current device:* a mechanical switching device intended to isolate a circuit under specified conditions. When introduced into a lighting circuit to reduce the risk of electric shock, such a device should have a residual operating current not exceeding 30mA and an operating time of less than 40ms.

1.8 *Separated extra low voltage:* An extra low voltage system which is electrically separated from earth and from other systems in such a way that a single fault cannot give rise to the risk of electric shock.

2 Light

Light is composed of photons, which may be thought of as mass-less particles, travelling at high speed (some 300,000,000 m/sec). The energy of the particles determines the colour of the light; thus high energy photons are perceived as ultra-violet and blue light and lower energy photons as red light. Particles of even lower energy with too little energy to be seen by the eye are perceived as heat. Light and heat are thus inextricably linked.

The colour quality of a light source is known as its colour temperature, the higher the colour temperature the more energetic the photons and thus the greater the relative light intensity at the blue and ultra-violet end of the spectrum. In practice, the colour temperature does not relate to the actual temperature of either the light source or the fittings.

Sunlight, which tends to be our point of comparison when considering light, has a colour temperature of about 6000K. Although this radiation is of high energy, much of the ultra-violet light is filtered out by the atmosphere. This effect is greater away from the poles

and is particularly noticeable in the morning and evening when the sunlight has to travel through a greater thickness of the atmosphere to reach the ground when the light is noticeably red.

Quartz halogen lights are some of the most intense that are used in commerce and industry and these have a colour temperature of some 3500K. Although they produce a light that has a significant ultra-violet component, there is a considerable production of infra-red light which is evident as heat.

In contrast, lamps with a colour temperature of 3000K are often thought of as producing 'warm and inviting' light and are used in coffee shops, restaurants and hotel lobbies.

Lamps that appear 'cool' are often used in hospitals, conference rooms and classrooms and these have a colour temperature of 4100K.

Almost all forms of lighting, however, use power relatively inefficiently and typically result in over 90% of the energy being converted to heat, rather than light.

3 Fixed installations

Luminaires in fixed lighting systems were traditionally based on incandescent bulbs and fluorescent tubes but new technology has resulted in the introduction of other forms of illumination including high intensity discharge lamps and quartz halogen bulbs. The temperatures of these sources can be much greater than those with which staff are familiar and the manner in which the lighting is used has resulted in the proliferation of many small lights, especially in retail units.

3.1 General precautions

3.1.1 All fixed lighting should be installed in accordance with the operating and installation instructions supplied by the manufacturer.

3.1.2 All fixed lighting should be installed by a competent electrician.

3.1.3 All fixed lighting should be wired and fused independently from circuits providing power for any other equipment. (Mains powered smoke alarms, where their installation is appropriate, are an exception to this guidance as it is permissible for them to be installed on lighting circuits.)

3.1.4 Fixed wiring for all installations, including lighting circuits, should be subject to periodic inspection and testing according to BS 7671 (ref. 1). The interval between inspections should be determined during the fire risk assessment for the building but in most premises it should be carried out at least every five years.

3.1.5 When planning lighting installations, the need to be able to reach the luminaires for periodic inspection, including the changing of bulbs, should be borne in mind.

3.1.6 Metal casings, brackets, shades, reflectors and similar components of lighting fittings should be bonded and earthed.

3.1.7 All lighting fittings should be properly secured in position. Where they are suspended, the material used for that purpose should be sufficiently strong to withstand the effects of movement caused by draughts and similar influences.

3.1.8 Unless designed to be connected directly to the circuit wiring, at each fixed lighting point one of the following should be used:

- a ceiling rose.
- a luminaire supporting coupler.
- a batten lampholder.

3.1.9 Where small lights are to be suspended by their cables, care should be taken that the weight to be supported is not excessive for the wire and accessories to be installed.

3.1.10 When the reflectors, shades or other components are to be changed, the adequacy of the means of supporting the lighting units should be re-assessed.

3.1.11 The periodic inspection of the lighting should include a visual inspection of the means of suspension, to ensure that it remains fit for the purpose for which it is intended.

3.1.12 A lighting installation should be controlled by means of a switch or switches, or a suitable control system which, where necessary, should be designed for use with discharge lighting circuits. Switches and other control systems should be installed in readily accessible positions where they will not put the operator in danger.

3.1.13 Care must be taken in all instances where lights are controlled by timers, whether for security purposes or otherwise. Timers should not be used if there is a possibility that a light unit may be inadvertently covered or knocked over while not in use. Similar care must also be taken with lights that are activated by photoelectric cells.

3.1.14 The use of lighting controlled by timer mechanisms or photoelectric cells should be reviewed whenever contractors are at work on the premises.

3.1.15 Managers should liaise closely with contractors working in their premises. Contractors should be prohibited from covering lights and be required to inform managers of any changes to the switching arrangements for the lighting in areas occupied by company staff.

3.1.16 All replacement lamps should be manufactured by reputable companies and comply with the appropriate standards.

3.1.17 All lighting circuits other than separated extra low voltage systems (that is, systems that are electrically separated from earth and operate at a voltage not exceeding 50V ac or 120V dc) should be provided with an earth conductor.

3.1.18 All high voltage electric sign and high voltage luminous discharge tube installations, shall be constructed, selected and erected in accordance with the requirements of BS 559 (ref. 2).

3.1.19 Lighting designed for use outside the earthed equipotential zone (for example, lights used in gardens and grounds) should be protected by a residual current device or operate at extra low voltage (less than 50V ac).

3.1.20 All staff should be vigilant and report:

- Any instances of combustible materials seen in the immediate vicinity of luminaires in the workplace.
- Any instance of water seen leaking into buildings around ceiling roses and the like.
- Any indication of overheating of fittings (such as discoloration of plastic bayonet fittings or the material on which the lighting unit is attached).
- Any malfunction or prolonged flickering of lights.
- Any fish-like odour that is coming from the luminaire or its fittings.
- Areas where additional lighting is required or the existing lighting is perceived as being too intense.
- Any unauthorised attempts that are made to reduce the intensity of a light by covering or shading the unit. Replacing the bulb or tube with one of lower wattage is a much safer alternative.

3.1.21 Light units that are damaged or broken should not be used; suitable remedial action should be taken as soon as possible.

3.1.22 When a fuse ruptures or circuit breaker trips as a result of a light bulb blowing or a fault in a light fitting, the problem must be identified and the unit be repaired, replaced or taken out of service before the power is restored.

3.1.23 While there are advantages in leaving lights in buildings on at night as a security measure, significant energy savings may be made by reducing the number of luminaires left switched on without reducing the deterrent value of the lighting.

3.1.24 Specialist advice should be taken regarding the positioning, operation and form of external security lighting, especially when it is an important ancillary to a CCTV installation.

3.1.25 Specialist advice should be sought with regard to health and safety hazards associated with the introduction of unenclosed lasers into the workplace. Great care must be taken to ensure that lasers cannot shine directly into people's eyes.

3.1.26 There are many health and safety issues regarding electric lighting and reference should be made to other sources of information for additional material as necessary.

3.2 Fireman's switches

3.2.1 A fireman's switch should be provided in the low voltage circuit supplying:

- exterior electrical installations operating at a voltage exceeding low voltage,
- interior discharge lighting installations operating at a voltage exceeding low voltage.

This requirement does not apply to a portable discharge lighting luminaire or to a sign of rating not exceeding 100W and fed from a readily accessible socket outlet.

3.2.2 Fireman's switches should be located out of reach of the public but accessible to the fire brigade. Prominent notices should be displayed identifying the switches and the equipment they control.

3.2.3 Before pitching a ladder against a building to which luminous discharge lights are fitted, or working near such signs, the circuit should be isolated by pushing the switch upwards.

3.2.4 Every discharge lighting installation on the exterior of each premises should be controlled by a single fireman's switch.

3.2.5 Similarly, every internal discharge lighting installation shall be controlled by a single fireman's switch, independent of any switch for the exterior installation.

3.2.6 At the time of writing the draft Regulatory Reform Order (ref. 3) requires that not less than 42 days before the installation of relevant apparatus, the fire authority be notified of the location of the fireman's switches and how they are to be coloured and marked. A cut-off switch installed in compliance with BS 7671 (ref. 1) is deemed to meet this requirement but the fire authority should still be informed of the proposed installation for their records.

3.3 Installations in ceilings

3.3.1 Where a quartz halogen downlighter or other form of recessed luminaire is used in a fire rated ceiling, a suitable back plate or cover should be fitted so as to maintain the fire resistance of the ceiling.

3.3.2 Suspended ceilings are often installed in commercial premises; these consist of metal

frameworks supporting acoustic or decorative panels. Such frameworks are generally not considered to be extraneous or exposed conductive parts and do not require to be bonded and earthed.

3.3.3 Cables should not be laid directly on the ceiling grid, to prevent contact with any sharp edges that may be present. They should be supported by a suitable catenary system, by cable trays or trunking, or be attached to the ceiling support rods by cable ties or clips.

3.3.4 Final connections to luminaires should be by means of a luminaire support coupler, keeping the final flex connection as short as possible. This method of connection has the benefit of allowing some degree of flexibility regarding the position of the luminaire.

3.3.5 Lighting diffusers are translucent or open structured elements that allow light to pass through. Diffusers intended to form parts of a fire rated ceiling should have been satisfactorily tested as part of the ceiling system that is to be used. This condition does not apply to any diffuser that forms part of a light fitting fixed beneath or suspended from the ceiling.

3.3.6 In the case of diffusers that form part of a fire rated ceiling, the wall and ceiling surfaces exposed within the space above the diffuser should be lined with materials suitable for the location in which the light fitting is situated.

3.3.7 There are no restrictions on the extent of diffusers that may be installed if they are of classification TP(a) (rigid). If the diffusers are of classification TP(b), however, the conditions on their use set out in Approved Document B to the Building Regulations 2000 (ref. 4) should be complied with.

3.4 Incandescent lamps

Incandescent lamps, or bulbs, are the least efficient form of lighting due to the amount of energy consumed heating the filament in an atmosphere of argon at low pressure in order to make it glow and produce light. These light bulbs tend to have a short life of 500 to 3000 hours but are cheap and easy to install and replace.

The envelope temperature of a filament bulb depends on the wattage of the bulb but in the case of domestic light bulbs is not normally high enough to ignite cellulose materials with which they come into contact. Small amounts of paper or fabric in contact with bulbs may scorch but do not normally ignite. Larger quantities of paper or cloth have an insulating effect and cause the envelope temperature of even a low wattage bulb to rise significantly (to over 500°C), resulting in the ignition of the material.

Long life light bulbs operate with a lower filament temperature than standard bulbs and thus the envelope does not reach the same temperature.

If a bulb breaks, the filament remains glowing for a very short time before it oxidises and burns but it is capable of igniting materials such as flammable liquids and gases and even easily ignitable solids. The arc that results when the lamp breaks is also capable of igniting flammable gases in the vicinity.

Compact fluorescent lamps are now available as economic direct replacements for incandescent lamps. These have also the advantage of a cooler running temperature.

3.4.1 Incandescent light bulbs should not be allowed to come into contact with combustible materials.

3.4.2 Where the maximum wattage of a bulb is specified on a shade or fitting this should be not be exceeded.

3.4.3 While incandescent bulbs may be replaced by compact energy saving fluorescent lamps, an example of which is shown alongside (other designs exist), this should only be done where it can be undertaken without modifying the light fittings in any way. It should not be done where the lamp is controlled by a dimmer circuit.

3.4.4 Care should be taken to ensure that replacement lamps with Edison screw fittings are screwed fully into place (but are not over tightened) to prevent arcing occurring at the base of the fitting.

3.4.5 When supplied by direct current, care should be taken to ensure that Edison screw fittings are connected with the correct polarity.

3.4.6 Except in certain circumstances, for example where a lampholder and its wiring are enclosed in earthed metal or insulating material or where separate overcurrent protection is provided, a lampholder shall not be connected to any circuit where the rated current of the overcurrent protective device exceeds the value indicated in Table 1.

3.4.7 A filament lamp should not be installed in a circuit operating at a voltage exceeding 250V.

3.4.8 A ceiling rose shall not be used for the attachment of more than one flexible cord unless it has been specially designed for multiple pendants.

Table 1. Overcurrent protection of lampholders

Type of lampholder	Type of fitting device protecting the circuit	Maximum rating (amps) of overcurrent
Bayonet fittings	B15 SBC	6
(BS EN 61184) (ref. 5)	B22 BC	16
Edison Screw	E14 SES	6
(BS EN 60238) (ref. 6)	E27 ES	16
	E40 GES	

3.5 Fluorescent light tubes

Fluorescent light tubes consist of a sealed glass tube containing an electrode at each end. The tube is filled with mercury vapour at a low pressure and coated internally with a mixture of chemicals that fluoresce in ultra-violet light. A choke is present in the circuit to assist in the starting of the light and prevent a harmful rise in voltage. When switched on, a started circuit provides a sufficiently high voltage to initiate a discharge in the mercury vapour in the tube. The arc produced results in the emission of light, especially ultra-violet light that in turn causes the coating of the tube to glow.

Fluorescent light tubes are an effective method of producing light from electricity and produce less heat than incandescent bulbs. They can have a life of up to 24,000 hours. Fluorescent lamps, however, are more expensive and complex as they incorporate a ballast circuit.

Fluorescent light tubes do not get excessively hot apart from in the region of the electrodes, where temperatures of 60-80°C may be attained. The chokes, however, can overheat and some fires have been attributed to this cause.

3.5.1 Fluorescent lights should not be attached directly to a combustible surface.

3.5.2 When fluorescent light tubes start to flicker they should be replaced as the faulty tube is likely to overheat.

3.5.3 Leaving a failed tube in a fitting, using tubes of the wrong specification, incorrect wiring, incorrect voltage or power surges can lead a ballast to fail. One of the symptoms of ballast failure is that they can become very hot and thus be a fire hazard. Although ballasts should incorporate a thermostat, when this operates and they cool down, the power will then come back on. Fluorescent lights that turn off and then on again intermittently may be suffering from a ballast failure and should be taken out of service.

3.5.4 Where old ballasts (pre 1979) are to be replaced and are found to be leaking a clear or light coloured oil, they should not be touched until specialist advice has been sought as they may be leaking polychlorinated biphenyls (PCBs), which are now recognised as being carcinogens.

3.5.5 Where ultra-violet tubes are in use in discos and similar places of entertainment, they should be suitably protected or be positioned out of sight to protect the eyes of everyone in the vicinity.

3.5.6 Used fluorescent light tubes should not be disposed of with normal commercial rubbish but be treated as hazardous waste. Tubes that are no longer serviceable should be collected together in a safe place to await disposal. It is sound practice to place lamps that have been removed from service in the packing provided with the new lamps.

3.5.7 All pieces of any broken tube should be swept up and stored in a similar manner. Specialist advice should be sought regarding the safe disposal of fluorescent light fittings, especially those containing mercury.

3.5.8 The breaking of used lamps to reduce the bulk for storage should be avoided wherever possible. Where it is unavoidable, suitable protective clothing (including eye protection) must be worn and the operation be carried out in a well-ventilated area or outdoors.

3.5.9 Care should be taken when handling fluorescent light tubes since, if they break and a cut results from phosphor-coated glass the healing process may be interfered with. If a cut is received, medical attention should be sought with the medical staff being informed of the cause of the injury.

3.6 High intensity discharge lamps

This form of lighting is ideal for stores, warehouses, auditoriums, outdoor parking areas and applications where efficiency is a priority. High intensity discharge lighting is also used in medical equipment and in domestic and commercial sunlamps. The lamps operate at high internal temperature (up to 1300°C) and pressure (up to 6bar in the case of metal halide lamps and 3.5bar otherwise) and thus the consequences of a catastrophic failure could be serious. The lamps, which range in output from 75 to 1500W, have a life of between 5,000 and 24,000 hours and produce a greater amount of light than a standard halogen bulb, while consuming less power.

Street lighting is of this form, the lamps incorporating sodium in the construction to emit an intense yellow colour. Other lamps incorporate mercury vapour or metal halides, such as sodium iodide or scandium iodide, as light-producing elements.

The light is produced from an arc discharge between two electrodes in a sealed glass capsule. To operate, the bulb requires a ballast circuit, which supplies the correct starting voltage to strike and maintain the arc, and regulate the current once the arc is established.

High intensity discharge lights, an example of which is shown alongside, require a warm-up period, typically of the order of 20 seconds, before reaching their full light output. If power to the lamp is lost, or the lamp is turned off, the tube must be allowed to cool before the arc is restruck.

3.6.1 Care should be taken when planning the locations of high intensity discharge lamps. They should not be sited directly over combustible materials where hot particles from a broken bulb could ignite materials below. Shelving or piles of stock should be arranged so that the lamps are above aisles.

3.6.2 High intensity discharge lamps should also be sited well away from combustible elements of construction.

3.6.3 Care should be taken to prevent water ingress into light fittings, especially in the case of sodium lights.

3.6.4 Although the bulbs are available separately, they should always be used within enclosures. New lamps are manufactured with suitable protection. The use of these light fittings with integral containment barriers made of tempered or borosilicate glass is recommended. Plastic or aluminium components may melt and should not be used.

3.6.5 In the case of open fixtures where a containment barrier cannot be fitted, a shroud should be introduced to protect the arc tube.

3.6.6 The advice of the manufacturer should be sought before retrofitting containment barriers as this can cause overheating of some types of lamps.

3.6.7 The types and ratings of the lamps selected for specific locations should be appropriate for the fittings and meet the manufacturer's specifications. Care should be taken to ensure that the lights are used in the specified horizontal or vertical orientation.

3.6.8 The bulb and ballast must be correctly matched. If the bulb is too small for the ballast, it can overheat and explode. Conversely, if the bulb is too big it will have a shortened life and, in addition, the ballast may overheat as the bulb is not able to reach the correct working temperature.

3.6.9 When assessing the risks associated with the location of high intensity lamps, the temperatures reached by the fittings and the radiant heat flux from the bulb should also be taken into consideration.

3.6.10 Because metal halide bulbs operate at very high temperatures and pressures the glass lamps should be handled with care and kept clean. New bulbs should not be touched with bare hands; contamination can degrade the lamp performance and cause premature failure. If necessary, the lamp may be carefully cleaned by wiping with a lint-free cloth or swab moistened with denatured alcohol. Care should be taken to avoid touching the inside surface of the reflector and the connecting wires.

3.6.11 Lamps with evidence of scratching or other form of damage should not be used.

3.6.12 Symptoms of the approach of the end of life for a discharge tube include low light output and intermittent starting. Visual signs include blackening at the ends of the tube. It is advisable to replace discharge tubes at 70% of their rated life before they fail completely. This is also an economic factor as lights reaching the end of their life draw more power and thus become less economic to operate.

3.6.13 Bulbs should only be replaced by a suitably trained competent person, and only when the lamps are cold and the power has been locked off.

3.6.14 When replacing lamps, the new bulb must have the same coding letter as the one that is removed. Substituting a different type of bulb may result in incompatibility with the ballast, arc voltage or power supply.

3.6.15 In some fittings the discharge tubes operates at direct current (dc) and thus the polarity of the wiring must be strictly observed.

3.6.16 As indicated above, in all cases where bulbs or ballast units are being replaced, care must be taken to ensure that electronic ballast units and the intended bulbs are compatible.

3.6.17 Bulbs with an intermittent fault that causes them to switch on and off need to be replaced immediately, following testing of the unit. The fault may be caused by problems with the ballast or overheating.

3.6.18 Failed discharge tubes should be disposed of in a proper manner; they should not be discarded with other rubbish as they may contain traces of metals such as mercury that are hazardous to health and the environment.

3.6.19 The installation of high intensity discharge lamps from 'kits' of parts should only be undertaken by a competent person. Existing fittings should not be modified nor non-approved containment barriers introduced without consulting the manufacturer.

3.6.20 Where lamps are operated continuously, they should be switched off for at least 15 minutes every week. Any defective lamps liable to fail should be identified by this control procedure.

3.6.21 Personnel should not stare at discharge tubes when they are in operation. Staff likely to work on the light units should be instructed in the ultra-violet light hazards associated with the units and the necessary safety measures to be taken.

3.6.22 Appropriate staff, such as lift truck drivers, should be instructed in the hazards of the lights and the measures to be observed when operating in their vicinity.

3.6.23 No attempt should be made to remove discharge tubes while they are hot and they should never be handled while switched on.

3.6.24 Because of the hazards associated with sodium, mercury or other metals, high intensity discharge lamps should not routinely be broken prior to disposal.

3.7 Luminous discharge lamps

The form of luminous discharge lamp commonly used for advertising signs is a type of high intensity discharge lamp. These tend to be long tubes of small diameter that can be bent to form letters or symbols.

When a high voltage is applied to electrodes in such a tube containing an inert gas at low pressure, the gas becomes luminous and emits wavelengths of light that are characteristic of that gas. Thus neon produces a red light, carbon dioxide white light and hydrogen green.

The tubes require a voltage of some 3000V or more to operate and thus transformers are used to step up the voltage to this level. In practice, there may be several such transformers and associated control circuits installed as part of a single installation; the hazard being addressed by the provision of fireman's switches

3.7.1 Luminous discharge lamps forming advertising and similar signs should be positioned so as to be out of reach from ground level and any walkways in the vicinity.

Conditions regarding fireman's switches that should be installed to isolate these forms of lighting are set out in 3.2.

3.8 Quartz halogen lamps

Quartz halogen lamps are relatively cheap and require no starter circuits. They consist of a small bulb with an incandescent tungsten filament, with the gas in the envelope containing traces of a halogen, usually iodine. They are more expensive to run than discharge lamps.

In order for the lamp to work efficiently, the glass envelope of the bulb must be small and very hot, generally over 250°C; it is therefore made of either quartz or heat-resistant glass. Although this form of envelope withstands heat better than glass, it has a disadvantage of absorbing less ultra-violet radiation. Exposure of the skin to ultra-violet radiation increases the risk of developing skin cancer.

As the bulb is small and strong, it is filled with inert gas (in the case of quartz halogen lamps, krypton or xenon), to a higher pressure than is the case for normal incandescent bulbs.

The compact filament area makes it easy to focus the light onto small areas and thus these lamps are often used for feature lighting. Quartz halogen lamps, an example of which is shown alongside, may operate at mains voltage or a lower voltage through a transformer.

When mains voltage halogen lamps come to the end of their life there is a chance of internal arcing and they can be designed to prevent this from occurring (sometimes by incorporating an internal fuse). Some lamps, however, can shatter and this can lead to serious injury and damage.

The temperature of the envelope of quartz halogen lights have has been measured and found to be as high as 600-900°C in some instances. The temperature of the housing or reflector associated with the lamp may also be proportionately high. Combustible materials in contact with a quartz halogen bulb, or in some cases in the reflector or fittings, may therefore ignite in a short period of time.

Halogen lamps have the capability to ignite fuels by radiant heat and to melt diffusers, shades and fixtures.

Some bulbs have also been known to shatter as a result of traces of sweat being left on the glass by the installer. This can have charred to carbon, resulting in local overheating of the small black spot on the surface of the bulb.

3.8.1 When assessing the risks associated with the location of quartz halogen lamps, the temperatures reached by the fittings and the radiant heat flux from the bulb should also be taken into consideration.

3.8.2 Lamps should not be attached directly to combustible elements of construction.

3.8.3 When fitted to the outside of buildings, quartz halogen lamps should not be sited where the heat from the bulb or casing will present a hazard to soffits, eaves or other combustible materials.

3.8.4 Where necessary, measures should be taken to prevent birds from nesting on top of external lighting units.

3.8.5 Quartz halogen lamps should not be fitted anywhere on the outside of any building with a thatched roof without first consulting the insurers of the property.

3.8.6 Care must be taken to ensure that when incandescent bulbs are replaced with halogen lamps, the fittings are suitable to cope with the larger heat outputs that may result.

3.8.7 Where possible, the use of dimmer controls in retail shops and similar premises should be avoided, the lamps being replaced with units with lower light output. Where dimmers are used to 'soft start' the lamps to prolong their life, the equipment must be compatible to cope with the particular lamps that are installed in the circuit.

3.8.8 A minimum distance of 45cm (18in) or the minimum distance recommended by the manufacturer, whichever is the greater, should be kept between a tubular halogen light bulb and any combustible material. Particular care in this respect should be taken in retail premises and similar properties or where there may be some movement of combustible materials in the immediate vicinity of quartz halogen lights.

3.8.9 All tungsten halogen lamps should either be fitted with an appropriate ultra-violet filter or a bulb with a glass outer element.

3.8.10 The use of unfiltered desk top lamps should not be permitted if they are used for more than two hours a day and are sited within 0.6m of the user.

3.8.11 If a lamp is fitted with a double walled bulb and the outer wall is broken, the bulb should not be used, but should be replaced.

3.8.12 Lighting track systems should comply with BS EN 60570 (ref. 7).

4 Portable lighting

Although construction sites and work in some remote locations comes into mind when considering portable lighting, the proliferation of electrical equipment in offices has also resulted in the introduction of desk and standard lamps, which are also portable electrical appliances. These are also associated with extension leads and electrical adaptors, which are themselves hazardous and require maintenance and management.

4.1 Portable equipment

In common with all other items of portable electrical equipment, portable lamps of all types should be subject to periodic inspection and testing in order to satisfy the requirements of the Electricity at Work Regulations 1989 (ref. 8). This normally takes the form of portable appliance testing (PAT).

The legislation does not define the period between tests. One solution is to test all portable lights at a defined period, say annually, but in large organisations with a wide range of different forms of portable lighting a risk assessment approach is preferable. This allows annual testing of items that are rarely moved around the premises while identifying lights, such as inspection lamps on leads or floodlights on tripods that are subject to a great deal of handling, to be tested more frequently, say every three months.

Whatever the defined period between tests, it is of the utmost importance that staff remain vigilant and carry out a brief visual examination of their equipment on each occasion that it is used. Any faults, including minor chafing of cables and the like, should be reported to the responsible person without delay, the apparatus being clearly labelled and taken out of use until the problem is rectified.

The temperatures indicated for various types of lights in section 3 assume that the units are fitted properly, with free circulation of cooling air around them. In the case of portable lighting there is a much greater likelihood of the lamp coming into contact with combustible materials or being dropped, knocked over or otherwise misused to create a potential source of ignition.

4.1.1 All portable lighting should be fused appropriately. Where connection is by means of a plug, it must be ensured that the cartridge fuse is suitable for the circuit (for lighting it should normally be a 3A fuse).

4.1.2 All portable lighting must be PAT tested periodically in compliance with the Electricity at Work Regulations 1989 (ref. 8). The results of the testing should be recorded; this may be done electronically with each item of equipment being labelled with a number or bar code.

4.1.3 Any portable light where the luminaire, fitting, flex or cable has been damaged should be taken out of service immediately and be labelled to indicate that it is not to be used until it has been inspected and/or repaired by a competent person.

4.1.4 All portable lamps should be enclosed with guards to protect them from mechanical damage.

4.1.5 Portable lamps (other than desk lamps) should be turned off and unplugged at the end of the period of work.

4.1.6 Unless designed specifically for that purpose, portable lights must not be used in areas where there is a possibility of a flammable atmosphere being produced.

4.1.7 Because of the high temperatures reached by the lamps and fittings, it is recommended that quartz halogen lamps are not used for portable illumination.

4.1.8 Portable appliance testing must extend to decorative lights used in the workplace at the time of Christmas and other festivals. These lights should be turned off when the premises are vacated at the end of the work period.

4.1.9 Decorative lights (and decorations) should not be suspended from luminaires, automatic fire detectors, sprinkler heads or other safety equipment.

4.1.10 All types of light bulbs and luminaires retained for use in specialist applications should be clearly labelled as to the equipment for which they are intended, to prevent wrong bulbs being fitted, resulting in the production of excessive heat.

4.2 Temporary installations

4.2.1 All temporary installations, including those on construction sites, should be installed in accordance with the requirements of BS 7671 (ref. 1).

4.2.2 Temporary lighting used externally for visual effects should operate at extra low voltage and, unless specially designed for the purpose, should be sited away from water features and similar hazards.

4.2.3 All temporary electrical work on construction sites, including the provision of electric lighting, should be carried out by a competent electrician.

4.2.4 Temporary lighting installations should be inspected regularly and tested at intervals not greater than every three months. The results of the tests should be recorded.

4.2.5 Where a large number of temporary lights, or a temporary installation with a significant demand on power supplies is being planned (for example in the case of a temporary stage production), a competent electrician should be consulted.

4.2.6 All luminaires and catenary installations installed outside buildings should be planned so as to be safe from passing vehicles.

4.2.7 Similarly, any temporary installations planned within buildings should be well clear of hazards such as travelling cranes and other moving plant.

5 Battery-powered units

The powering of a lamp by a battery rather than a conventional power supply does not necessarily render the equipment harmless as a potential source of fire.

5.1 Battery-powered lights

Many incidents have occurred where incorrect replacement of bulbs or fuses has led to overheating and subsequent ignition of the units, on occasions leading to serious fires.

5.1.1 The manufacturer's instructions as to the use and care of the equipment must be followed, particularly with regard to recharging in the case of lamps powered by rechargeable cells.

5.1.2 Only torches and hand lamps specifically designed for the purpose should be used in areas where a flammable atmosphere may be produced.

5.1.3 No modifications should be made to torches to allow them to be used for purposes other than that for which they were designed. (For example, lamps with rechargeable batteries should not be modified to provide a power supply for hand tools unless specifically intended as such by the manufacturer.)

5.1.4 Rechargeable batteries should be recharged according to the manufacturer's instructions. The charging should be undertaken in an area away from combustible materials. Where there are numbers of items to be charged, this should be undertaken in an area designed for this purpose.

5.1.5 No attempt should be made to recharge batteries that were not designed for this purpose.

5.1.6 Where several chargers are available for use in the same area, the equipment for which each is intended should be clearly identified.

5.1.7 Spare batteries for torches should be stored in a clean, dry place away from direct sunlight. Where rechargeable or non-standard batteries are kept for a specific purpose these should be labelled prominently to prevent them being selected for use in the wrong equipment.

6 Fighting fires involving lighting units

If smoke or flames are seen coming from any form of lighting unit, isolate the circuit by use of the switch where possible. In many cases, such as those involving the overheating of cables, removing the source of heat in this way may solve the problem.

Fires involving lighting units are best fought with carbon dioxide or dry powder extinguishers. Where the burning materials are within an enclosure or lighting unit, carbon dioxide may be the most effective extinguishing agent as it is able to reach the seat of the fire more easily, even though its heat-reduction capacity is limited.

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OTHER SOURCES OF INFORMATION

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