Loss Prevention Standards – Asset Classes

Lighting

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Lights and light fittings present a significant fire hazard. This document provides guidance and loss prevention advice in respect of this hazard

AVIVA

Lighting

Introduction

Lighting is something generally taken for granted and is often only noticed when it is either missing or of poor quality. However, lighting and light fittings can present a significant fire hazard, due to: the type of fittings used; combustible materials which are stored too close to the light fittings; environment they are used in and light fittings that are damaged or poorly maintained, etc. This exposure needs careful attention and requires to be managed just like any another other potential ignition source.

The key to managing this exposure is to prevent the fire triangle from being created, and understanding the light fitting is the ignition source:

- Install and maintain the devices correctly, so the ignition source is not readily available
- Ensure the environment is appropriate for the installed device
- Establish adequate clearance between light fittings and combustible materials. Remember that even 'temporary storage' can cause an issue
    - Temporary is a bit of a misnomer - it is actually permanent for a short period of time; a fire starting in this period is still a permanent fire
- Ensure there is appropriate ventilation

Electrical fires are caused by a number of issues, such as:

- Ignition of combustible materials or fabrics in contact with electrical equipment or unprotected light bulbs
- Overloading of conductors leading to overheating
- Breakdown of insulation leading to current leakage causing sparks
- Damage to fittings exposing live elements

Type of Lighting and Light Fitting

High Intensity Discharge (HID) Lighting – Metal Halide Lights

High Intensity Discharge (HID) lamps are a type of electrical gas-discharge lamp which produce light by means of an electric arc between tungsten electrodes housed inside a translucent or transparent fused quartz, or fused alumina arc tube.
This tube is filled with noble gas and often also contains suitable metal or metal salts (mercury vapour, high pressure sodium metal halide).

The noble gas enables the arc's initial strike, and once the arc is started, it heats and evaporates the metallic admixture. Its presence in the arc plasma greatly increases the intensity of visible light produced by the arc for a given power input, as the metals have many emission spectral lines in the visible part of the spectrum. HID lamps are a type of arc lamp.

High Intensity Discharge (HID) lighting is widely used in commercial and industrial facilities to provide an efficient, low cost light source. These lights operate at a high internal pressure and temperature (up to 6 bar pressure and 1,300°C), and so catastrophic failure is possible. HID lamps can explode on failure scattering hot glass and debris over a wide area, which apart from safety issues, has the potential to cause a fire if falling on combustible materials below. This event occurs more often than is realised. In addition, the capacitor on the upper part of the device stores electric charge. There have also been instances of fire caused by these when they are damaged, not maintained or housed too close to combustible materials.

In respect of Metal Halide lights, different types of lamps are manufactured for use within different types of light fittings as follows:

- O–Type: Shrouded tube or double containment feature designed for use in open fixtures
- E–Type: For use within light fittings that are designed with integral containment barriers
- S–Type: Non-shrouded lamp for use within enclosed or unenclosed fittings

In addition to Metal Halide lamps, the other two main types of HID lamps are:

- Mercury Vapour
- High-Pressure Sodium

Additional information and guidance can be obtained in the RISCAuthority document "RC37- Recommendations for the control of fire hazards arising from electrical lighting".

Specific Precautions for HID Lighting:

- ✓ Lamps should be used in accordance with the operating and installation instructions supplied by the manufacturer
- ✓ The lamp type and rating should be appropriate for the fitting and meet manufacturer's specifications
  - Bulbs and fittings should be correctly matched
- ✓ The use of light fittings with integral containment barriers for the appropriate lamp type (i.e., borosilicate glass or tempered soda lime glass) fitted below, that do not leave any gaps between the glass and the fixture is always recommended
  - Normal glass is unsuitable as it may shatter
  - Aluminium or plastic barriers can melt
  - Do not modify existing fittings or retrofit non-approved containment barriers without manufacturer's input and approval. Lamp rupture can be caused by incorrect heat dissipation
  - The lamp containment barrier will prevent fragments of hot glass or quartz from falling and igniting combustibles under them. Follow the lamp manufacturer's instructions for installation of the lamp to ensure proper application of the lamp, fixture, and associated auxiliary devices
- ✓ Alternatively, where containment barriers are not possible, consideration can be given to the use of lamps which either have the arc tube protected by a glass shroud (O-Type) or are shatter resistant
- ✓ Protect the lamp from contact with liquid, moisture, dust, dirt, oils, etc.
- ✓ Avoid water contact with the lamps as this can result in rupture due to thermal shock
- ✓ Never touch the lamp with bare hands
- ✓ Inspect the lamp before installing, and do not use any lamp that has been damaged or scratched. Physical damage may cause the lamp to fail unexpectedly
- ✓ Lamps must be kept well away from combustible elements of construction
- ✓ Due to the heat generated and the presence of stored charge in the associated capacitor unit, storage of any materials should not be permitted within 1.5m horizontally of the entire fitting, regardless of the nature of the fixture/fitting
- ✓ Ensure individuals using equipment such as fork-lift or reach trucks are provided with training to avoid any contact with lighting equipment
- ✓ Lamps should only be housed over sterile floor areas
  - Combustible stock should not be located below (even temporarily) - in the event of an uncontained failure this minimises the risk of hot particles falling onto combustible items
  - Even if shielded, storage should ideally not be permitted below…just in case
- ✓ Lamps should be inspected on a regular basis and any that are dim, flickering or not producing light should be replaced immediately
- ✓ Replacement of bulbs and other work should only be undertaken by properly qualified electricians and only when the lamps are cold and the power locked-off

- ✓ As failure rate increases with age, it is recommended that lamps are changed at 70% of their rated life
  - To accomplish this in a cost-effective manner, consider maintaining records of lamp operating hours and implementing group re-lamping
- ✓ To help prevent catastrophic failure lamps should not be operated continuously. They should be switched-off for at least 20 minutes per week

Fluorescent Tube Lighting

A fluorescent lamp, or fluorescent tube, is a low-pressure mercury-vapour gas-discharge lamp that uses fluorescence to produce visible light. An electric current in the gas excites mercury vapour, which produces short-wave ultraviolet light that then causes a phosphor coating on the inside of the lamp to glow. Fluorescent lamps convert electrical energy into useful light much more efficiently than incandescent lamps. The typical luminous efficacy of fluorescent lighting systems is 50–100 lumens per watt, several times the efficacy of incandescent bulbs with comparable light output.

Fluorescent lamp fixtures are more costly than incandescent lamps because they typically offset the higher initial costs.

Because they contain mercury, many fluorescent lamps are classified as hazardous waste.

The main fire exposure from these lights is the continual striking where non-safety starter motors are used, and the heat generated from the ballasts.

Halogen Lighting

A halogen lamp, also known as a tungsten halogen, quartz-halogen or quartz iodine lamp, is an incandescent lamp consisting of a tungsten filament sealed into a compact transparent envelope, that is filled with a mixture of an inert gas and a small amount of a halogen such as iodine or bromine. The combination of the halogen gas and the tungsten filament produces a halogen cycle chemical reaction which redeposits evaporated tungsten to the filament, increasing its life and maintaining the clarity of the envelope. Because of this, a halogen lamp can be operated at a higher temperature than a standard gas-filled lamp of similar power and operating life, producing light of a higher luminous efficacy and colour temperature. The small size of halogen lamps permits their use in compact optical systems for projectors and illumination.

Light Emitting Diode (LED) Lighting

Light Emitting Diodes are commonly called LEDs, and this refers to a type of diode which provides light when electricity passes through it. LED lamps have a lifespan and electrical efficiency which are several times greater than incandescent lamps and are significantly more efficient than most fluorescent lamps. LEDs use only about 10% of the energy which an incandescent lamp requires.

Similar to incandescent lamps and unlike most fluorescent lamps (e.g., tubes and compact fluorescent lamps or CFLs), LEDs come to full brightness without need for a warm-up time. The initial cost of LEDs is usually higher. Degradation of LED dye and packaging materials reduces light output to some extent over time.

Some LED lamps are made to be a directly compatible drop-in replacement for incandescent or fluorescent lamps. An LED lamp packaging may show the lumen output, power consumption in watts, colour temperature in kelvins or description (e.g., "warm white", "cool white" or "daylight"), operating temperature range, and sometimes the equivalent wattage of an incandescent lamp of similar luminous output.

Combustible Materials

If we know the light fitting is the ignition source, then management of the combustible fuel load is important in ensuring a fire is never realised, e.g.:

- Storage or combustible materials too close to light fittings
- Storage located below light fittings that are known to fail catastrophically
- Light fittings passing through or fitted to combustible construction or combustible insulation
- Incorrect light fittings for the expected (hazardous) atmosphere, such as flammable gas, combustible dust, fly/debris
- Hostile atmosphere or weak housekeeping regimes causing dust or debris deposition

The light fitting needs to be selected for the environment expected at all times, and this includes during any daily, weekly or seasonal fluctuations; changes on site; temporary conditions, etc.

Loss Prevention Advice

- ✓ Ensure that the whole electrical installation complies with the latest revision of the Institution of Engineering and Technology (IET) Wiring Regulations (BS 7671)
- ✓ Ensure that only competent persons carry out installation, maintenance, repairs and testing (e.g., National Inspection Council for Electrical Installation Contracting (NICEIC) registered)
- ✓ Make appropriate use of residual current devices (RCDs) to protect from electric shock
- ✓ Lighting fixture positioning must also be considered to prevent impact damage
- ✓ Undertake simple regular visual checks to ensure the installations are in good condition; check for:
    - Damage to ballasts, cables, housings, bulbs, etc.
    - Lights continually striking or flickering
- ✓ Maintain and care for lighting (bulbs, fittings and wiring) as you would all electrical devices
- ✓ Utilise non-striking safety starter motors (where employed) to prevent continual striking (light flickering)
- ✓ Always locate lights over sterile areas and aisles, never above storage or combustible items
    - Never permit storage, temporary or otherwise, in aisle ways – these should be sterile
- ✓ Always maintain at least 1.5m horizontal distance between combustible materials and light fittings
- ✓ Utilise thermographic camera technology to support other loss prevention measures. These cameras can prove invaluable in understanding the fire exposure from light fittings
- ✓ Consider replacing devices for less hazardous lighting units if necessary
- ✓ Ensure there is appropriate ventilation to prevent light fittings over heating

Incident Examples

1) Staff for the tenant saw flames within the warehouse storage area and raised the alarm. The fire caused extensive damage to the unit. Heat from the fire caused significant structural damage and twisting/collapse of the portal frame, which resulted in movement and partial collapse of the brick infill walls. The party wall between the units prevented the fire spreading, but it bowed due to the intense heat and movement of the steel roof trusses and columns. The roof exploded, with shards of asbestos and debris littered across the surrounding areas and the roofs of nearby units. As a result, a cordon was maintained in place for some time while asbestos removal and clearance was undertaken. The fire was caused by the ignition of stock items stored at high level on racking and in close proximity to a halogen light. Cost of the incident was approximately £2.7m.

2) During the lunchtime period a warehouse containing palleted stock was not occupied, but the lighting was switched-on. An employee from the offices noticed a fire emanating from the warehouse.
The fire quickly became too intense, so the fire brigade was immediately called. The fire was caused by a faulty light fitting. Cost of the incident was approximately £650k.

3) Within an industrial unit an individual was working at the time of the fire. They heard a bang and the sound of glass falling and then noticed flames soon afterwards. Combustible materials close to the seat of the fire were consumed, and flames spread vertically to the roof level and laterally throughout the front of the unit via combustible stock and packaging materials. Forensic investigations concluded that the cause was an explosive failure of a metal halide bulb fitted to a low bay unit. There was no safety guard on the light in question.

   The roofs above three adjacent units were all affected. Unit A was severely smoke logged and there was extensive damage to the roof, with steel framework at high level distorted from the heat and horizontal sheeting rails twisted. The entire roof covering required stripping and replacing. There was smoke contamination in the adjacent unit B and water ingress from extinguishment attempts and subsequent rainfall. Unit C was damaged by water related firefighting operations. Cost of the incident was approximately £710k.

Checklist

A generic Lighting Checklist is presented in Appendix 1 which can be tailored to your own organisation.

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Aviva Risk Management Solutions – Specialist Partners

Sources and Useful Links

- The Electricity at Work Regulations 1989 (HSR25) – Health and Safety Executive (HSE)
- IET code of practice for in-service inspection and testing of electrical equipment
- BS 7671: Requirements for Electrical Installations (IET Wiring Regulations)
- The Management of Health and Safety at Work Regulations 1999 – Legislation.gov.uk
- IET Guidance Note 3 Inspection and Testing
- UL 1598 - Luminaires
- Lighting at work - HSG38 - (HSE)

Additional Information

Relevant Loss Prevention Standards include:

- Fire Safety Inspections
- Electrical Installations – Inspecting and Testing

To find out more, please visit Aviva Risk Management Solutions or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666.*

*Calls may be recorded and/or monitored for our joint protection.

Appendix 1 – Lighting Checklist

Location	
Date	
Completed by (name and signature)	

	All Lighting	Y/N	Comments
1.	Have all light fittings been identified so you know the actual fitting type and its location?		
2.	Are lights in use appropriate for the atmospheric conditions in which they are used? Including any hazardous atmospheres such as DSEAR/ATEX zones?		
3.	Are lamps inspected on a regular basis? Any that are dim, flickering or not producing light should be replaced immediately.		
4.	If dust or fly is a by-product of your activities are the light fittings selected with a low surface temperature/low heat emitting?		
5.	Are any light fittings passing or fixed to/through foam insulated metal panels? • Are all installations carefully reviewed? • Is all exposed foamed plastic insulation encapsulated in an appropriately approved fire resistive material? • To prevent cable insulation damage, are all cut metal panels grommeted?		
6.	Are any light fittings directly fitted to any other combustible elements of construction?		

	All Lighting Contd.	Y/N	Comments
7.	Are light fittings maintained at least 1.5m away from combustible materials or combustible construction horizontally? • Can the light fitting be moved? • Can the combustible materials be moved? • Can the combustible construction be protected with a non-combustible/fire resistant covering?		
8.	Are all light fittings located in areas where impact or vehicle impact is not expected?		
9.	Are light fittings considered and reviewed as part of regular housekeeping/inspection regimes?		
10.	Are light fittings properly maintained?		
11.	Are damaged light fittings electrically isolated until fully repaired?		
12.	Are light fittings cleaned regularly and maintained clean of dust and other accumulations?		
13.	Is there appropriate air movement to ensure light fittings remain cool?		
14.	Are light fittings checked at least annually with a thermographic camera?		

	HID Lighting	Y/N	Comments
15.	Is a record of the lamp installation date and recommended manufacturer's service life maintained?		
16.	As the bulbs can catastrophically fail, even if shielded, are HID lights located over sterile areas? • Are all combustible materials below prohibited? • Is temporary storage prohibited below HID lights?		
17.	Are light fittings with integral borosilicate glass or tempered soda lime glass containment barriers for the appropriate lamp type used?		
18.	Where containment barriers are not possible, are lamps used which either have the arc tube protected by a glass shroud (O-Type), or are shatter resistant?		
19.	Do the replacement of bulbs and other work procedures state that the lamps are not touched with bare hands?		
20.	Are all lamps protected from contact with liquid, moisture, dust, dirt, oils, etc.?		
21.	Are all lamps protected from contact with water?		
22.	Are all lamps that have been damaged or scratched isolated?		
23.	Are all HID lights turned-off for at least 20 minutes every week?		
24.	As failure rate increases with age, are lamps changed at 70% of their rated life?		
25.	Do the replacement of bulbs and other work procedures state that this should only be completed by properly qualified electricians and only when the lamps are cold and the power locked-off?		

	Fluorescent Lighting	Y/N	Comments
26.	Are flickering lights isolated and repaired immediately?		
27.	Where light fittings use starter motors, are non-striking safety starter motors used in all cases?		

28.	Additional comments:

Please Note

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