

# A Guide to Emergency Lighting

Third edition

*Chris Watts and Ian Watts*



**bsi.**

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# 1 Introduction

Emergency lighting has been developed over many years to provide illumination to allow occupants to use escape routes in the event of a failure of the normal lighting supply. It has traditionally been associated with fire protection systems and it has become an essential element to enable persons to escape from fires. But it also has an important function in the event of total or local supply failures, protecting users and giving them confidence to escape safely.

The task of emergency escape lighting is to assist people to evacuate buildings so we are able to use much lower light levels than are used for normal lighting. However, this makes it essential to design the system correctly to make effective use of it. Recent experience has shown that in many cases users are allowed to remain in a building during a mains supply failure, which is likely to require higher light levels and often larger areas of coverage. These systems are known as safety lighting and are now covered in BS 5266-1, *Emergency lighting –Part 1: Code of practice for the emergency lighting of premises*.

Many standards have been produced to endorse established good engineering practice in this important area of safety. With the changes in requirements and responsibilities defined in current legislation this book is intended to reveal the intention behind the requirements, to enable them to be interpreted better for specific applications.

## Emergency lighting terminology

For the purposes of British Standard BS 5266-1 and European Standard BS EN 1838, *Lighting applications — Emergency lighting*, 'emergency lighting' is the generic term for equipment that provides illumination in the event of failure of supply to normal lighting. There are a number of specific forms, as shown in Figure 1.

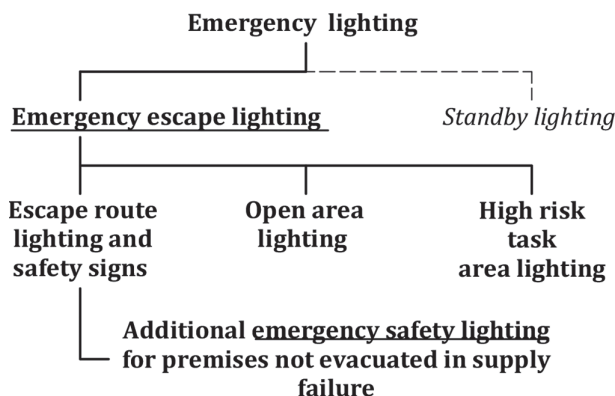


Figure 1 – Specific forms of emergency lighting

### **emergency escape lighting**

This is defined as that part of emergency lighting that is provided to enable safe exit in the event of failure of the normal supply. (This type of emergency lighting forms part of the fire protection of a building.)

### **emergency safety lighting**

That part of emergency lighting that provides illumination to protect occupants who remain in premises during a supply failure. This light level and duration would be decided by the risk assessor / user depending on the type of occupants and activities that will take place. The role of the competent engineer is to advise on the suitable illumination and luminaire locations to suit this application.

### **standby lighting**

This is that part of the emergency lighting provided to enable normal activities to continue in the event of failure of the normal mains supply. (This lighting does not provide fire protection unless it meets the same equipment, design and installation requirements as emergency escape lighting systems.)

## **Escape lighting systems**

### **escape route lighting**

This is the part of emergency lighting that is provided to enable safe exit for the building's occupants, by providing appropriate visual conditions and direction finding on escape routes and in special areas/locations

(e.g. corridors and stairs). It also ensures that fire-fighting and safety equipment can be readily located and used.

### **open area (or anti-panic area) lighting**

This is the part of emergency escape lighting that is provided to reduce the likelihood of panic and to enable the safe movement of the occupants towards escape routes by providing appropriate visual conditions and direction finding (e.g. in large rooms).

### **high risk task area lighting**

This is the part of emergency lighting that is provided to ensure the safety of people involved in a potentially dangerous process or situation and to enable proper shutdown procedures to be carried out for the safety of other occupants of the premises (e.g. to protect persons from dangerous machinery). This may include areas remote from the actual risk.

## **Development of legislation**

Emergency lighting is demanded mainly because of legislation. This legislation itself is a direct result of public and political pressure to safeguard life and to ensure uniform standards in places where the public gather.

In addition, local legislation is drawn up to meet specific and often local risks where these are not adequately covered nationally. The relevant fire authority<sup>1</sup>, jointly with the local authority building inspectors, enforces legislation and provides a local control.

Legislation is not the only factor in the decision to install emergency lighting. It may also be required to meet demands for safety, security, financial protection, or to maintain operation of a site.

### **History of the legislative process**

At one time, the only places that were required by law to install emergency lighting were cinemas, theatres and passenger ships, although emergency lighting was also common in hospital operating theatres. It was also used in some department stores and in premises licensed by the Magistrates' Courts.

However, social conscience was triggered by a few tragic incidents in places of public entertainment, hotels, old people's homes and licensed clubs. This initiated a multitude of mainly disconnected acts, by-laws,

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<sup>1</sup> Fire authorities are largely, though not completely, county brigades and there are specialist fire authorities for military and government properties.

regulations and standards. All imply or demand adequate lighting at all material times to provide means of escape for the public and employees.

The GLC (Greater London Council) and other local authorities when faced with large and concentrated risks, and in the absence of adequate national standards and legislation, pushed ahead with their own legislation, regulations and standards. Unfortunately, they did not agree on the requirements that should be met. This made product and application standardization difficult, and resulted in confusion as to which products were acceptable.

The Factories Act 1961 and the Offices, Shops and Railway Premises Act 1963 were introduced. These included measures to enforce public safety, including requiring emergency lighting, in places of work.

These two Acts were administered and enforced at local level by inspectors who were independent of the fire brigades and who advised on fire and emergency lighting equipment in places of public entertainment.

The Fire Precautions Act 1971 and the Health and Safety at Work etc. Act 1974, backed by existing legislation for cinemas, were strenuous efforts to bring order and consistency of requirements. They combined the enforcing powers and administration at local level and put them in the hands of the local authority fire service.

The local authority reorganization of 1975, which created larger fire authority areas and a more uniform structure, improved the effectiveness of the fire authorities as an enforcing power.

The introduction in July 1975 of BS 5266-1:1975, *Code of practice for emergency lighting — Code of practice for the emergency lighting of premises other than cinemas and certain other specified premises used for entertainment*, further improved the standard and uniformity of emergency lighting installations by defining the illumination needed, and the introduction of British Standard BS 4533-102.22:1990 (now developed and numbered as BS EN 60598-2-22, *Luminaires — Part 2-22: Particular requirements — Luminaires for emergency lighting*) helped to ensure an improved standard of performance and reliability.

New legislation promotes risk assessment techniques to demonstrate safety of a premises, so current standards provide information and guidance to assist engineers and users to compensate for potential hazards in a premises.

### **National legislation and standards**

Legislation is produced when the Government responds to the concerns, expressed by public or private bodies, for the need to introduce specific legal controls for the safety of the citizens. The Government approaches standards institutes, manufacturers' associations, professional bodies,

trade associations, research stations and representatives of those who will be affected to actively help in the drafting of the proposals.

Similarly, when the British Standards Institution (BSI) or any similar organization is producing a code of practice or equipment standard, the same bodies are involved and contribute to and influence the final form of the standard. The standards are being constantly developed. They reflect established good engineering practice and give guidance to assist the design installation and operation of appropriate systems.

All legislation, standards and other documents that are cited have been listed in a Bibliography at the back of this book. The latest, up-to-date editions at the time of publication of this book are listed.

## UK legislation

There is a considerable amount of UK national and local regulations affecting emergency lighting. The major items are given below.

### National regulations

**New buildings and major refurbishments.** Premises need to be safe and comply with relevant national and local building regulations.

**The safe use of all buildings.** Systems also need to be appropriately designed for the activities being conducted, the structure of the premises and the types of occupants. The UK guides to compliance with both these requirements refer designers to BS 5266-1.

NOTE Construction sites must also be safe for their workers. Guidance is given in the Construction (Design and Management) Regulations 2015.

- **New buildings requirements (see details in Chapter 11)**

Specific emergency routes and exits must be indicated by signs in accordance with the national regulations. Emergency routes and exits requiring illumination must be provided with emergency lighting of adequate intensity in case the lighting fails. The Building Regulations require escape routes, larger rooms, specific locations and points of emphasis to be illuminated as detailed in BS 5266-1. Compliance is normally checked by building control officers who must be satisfied before the building is put into operation. The Building Regulations cover other items of fire safety such as fire compartmentation and the adequacy of escape routes.

- **Safety in use of all buildings both new and existing. They must meet the ongoing requirements of fire safety legislation (see details in Chapter 10)**



The Fire Precautions Act, together with a number of other smaller fire safety laws, was superseded and replaced in England and Wales by the Regulatory Reform (Fire Safety) Order<sup>2</sup>, which obliges the responsible operators of buildings to perform risk assessments and limit the risks to tolerable levels. Scotland introduced the Fire (Scotland) Act 2005 and Northern Ireland passed the Fire and Rescue (NI) Order 2006; both of the documents cover the same principles as the Fire Safety Order, and the principles and requirements for emergency lighting and most other safety systems are similar to those in the documents for England and Wales. In England and Wales this is implemented by the guidance documents issued by the Office of the Deputy Prime Minister, which clarifies that this is done by the user performing a risk assessment for all premises in which people are employed. The fire and rescue authorities are responsible for auditing compliance. Scotland and Northern Ireland have equivalent legislation and guidance documents.

To assist employers or other 'responsible persons', also known as 'duty holders', the national fire authorities have produced guides for different applications. System designers can also find that the guidance in these documents is useful and they should be considered as part of the consultation process. Compliance with this procedure will be audited by the fire authorities at any time either at completion or in the future, so it is important for the user to obtain and retain for inspection satisfactory completion documentation and test records.

Details of this legislation and its impact are discussed in Chapter 10.

This fire safety legislation applies to the majority of premises and workplaces in the UK. But it excludes: dwellings; the underground parts of mines; anything that floats, flies or runs on wheels; offshore installations; building sites; and military establishments.

It firmly places responsibility on the employer or operator (who may delegate responsibility to a 'responsible person') of the building and outlines the measures that must be taken to ensure the safety of all the people that he or she is directly or indirectly responsible for. At the same time it allows the enforcing authority to make sure that it is enacted (by force of law if necessary) and defines the penalties the courts can impose in the event of noncompliance.

It requires the responsible person to carry out a fire risk assessment, produce a policy, develop procedures (particularly with regard to evacuation), provide staff training and carry out fire drills. The responsible person must also provide and maintain clear means of escape, emergency lighting, signs, fire detection, alarms and extinguishers.

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<sup>2</sup> The term 'UK fire safety legislation' is used to refer to the Regulatory Reform (Fire Safety) Order and the Scottish and NI equivalent legislation.

## **Local authority requirements**

Some workplaces require a licence from the local authority. The fire authority may require higher levels of fire precautions for specific premises. These include those that provide:

- the sale of alcohol;
- music and dancing;
- theatres and cinemas;
- gambling;
- sports stadia;
- public entertainment.

Some premises must be registered with the local authority and need to be accepted by the fire authority. These include:

- nursing homes;
- children's homes;
- residential care homes;
- independent schools.

## **Implementation of UK fire safety national legislation**

The changes in the way legislation is implemented have resulted in considerable changes in responsibility for the systems. The relevant fire authority used to define the areas that needed illumination in order to conform to BS 5266-1. When this and other fire safety measures were installed, the fire certificate was issued.

The employer is now responsible for their premises and for providing emergency lighting to reduce those risks to tolerable levels. Fire authorities will audit the provisions to ensure appropriate levels of safety of the occupants have been achieved. So the employer uses compliance with BS 5266-1 as a way of demonstrating compliance with their legal responsibilities.

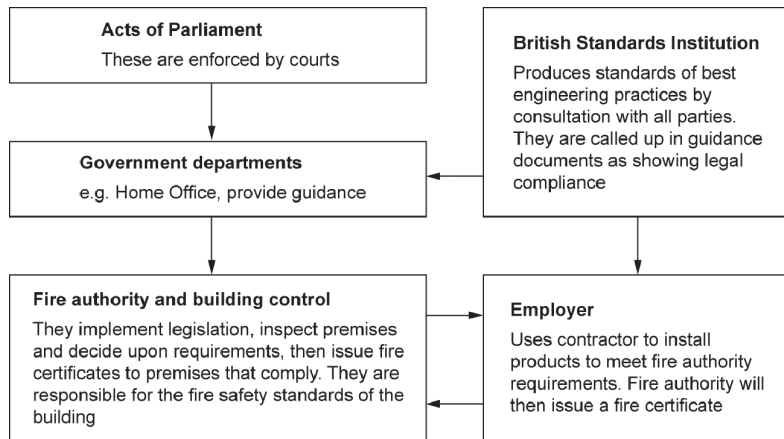


Figure 2 – Flowchart of implementation of previous legislation, the Fire Precautions Act and the Building Regulations, for designated areas of high risk

## Background to UK fire safety legislation

Currently, there are two legislative drivers to the fire safety market. New buildings and major refurbishments have to comply with the Building Regulations, which require both emergency lighting and fire alarms in most buildings. The building inspectors enforce these regulations during the construction phase and this protection will remain in place.

Most other fire safety legislation in the UK has now been replaced with a single Act. Now, the inspection of buildings and issuing of a fire certificate is limited to a very small number of high-risk premises. Most employers occupying other buildings will be required to conduct a risk assessment and make whatever changes are necessary. This new procedure is retrospective and so if a premises had a fire certificate issued 20 years ago, it will have to be reassessed and be upgraded to the latest issue of the standards. The risk assessment should be continuously updated to reflect any changes in risk to the premises and should be repeated on a regular basis normally no longer than every 12 months.

The outline of the procedure for employers with sites that are not classified as very high risk is as follows.

- They must appoint a 'responsible person' who has to provide the risk assessment.
- This person has to evaluate the hazards and the people at risk and then ensure that the fire precautions are adequate for that risk (meeting standards is deemed as complying).

- They are encouraged to use specialist competent people to assist them in providing reports on areas of risk and protection as needed.
- Written records must be kept for all premises with more than five employees.

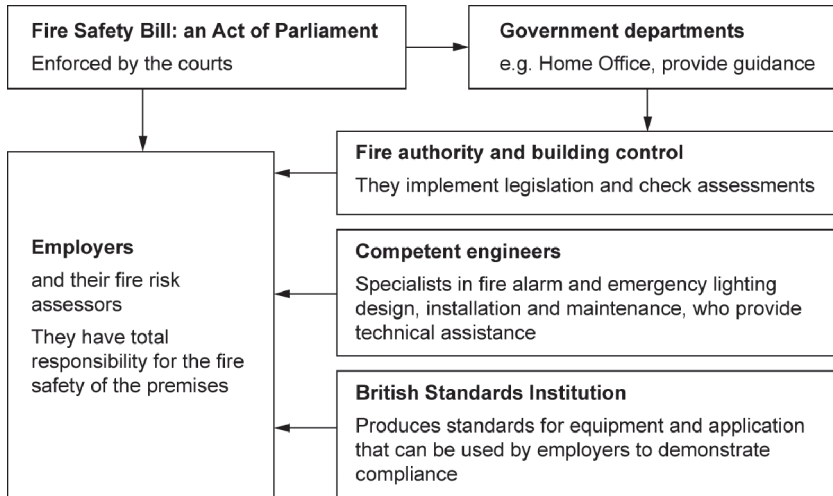


Figure 3 – Flowchart of implementation of current legislation, the Regulatory Reform (Fire Safety) Order and the Building Regulations

## Major implications of the UK fire safety legislation

It is important that employers understand their responsibilities to ensure that adequate emergency lighting and fire alarms are installed to safeguard occupants by understanding and complying with the fire safety legislation. New buildings will still have the support of building control officers to enforce the Building Regulations.

Employers will benefit by using the services of trained and competent engineers to assist in the design, installation and maintenance of fire protection equipment to ensure the quality, reliability and long life of the equipment. Greater confidence can be gained through using approved third party certified safety equipment.

Competent engineers should be able to give advice on how to provide systems compliant with the requirements of the relevant codes of practice for emergency lighting and fire alarm system design.

For normal applications, within the scope of the relevant application standard, the employer should be able to accept compliance with current published standards for system design as a basis on which to incorporate

the system design into their risk assessment in order to limit the risks to negligible or tolerable levels as required by the legislation.

Where the construction or operation of the building is such that increased hazards are present, or the risk of harm is higher than for a normal application, the employer (in conjunction with specialist advice where appropriate) should determine what, if any, additional measures are to be taken to limit the risks to negligible or tolerable levels.

### **Enforcement of UK fire safety legislation**

If the fire authority considers that a premises is not adequately protected, they can take various forms of action.

#### *Alterations notice*

An alterations notice requires the responsible person to notify the relevant fire authority of any proposed changes that may increase the risk in the premises. They are issued where the fire authority considers that the premises constitute a serious risk or may constitute a risk if changes are made.

#### *Enforcement notice*

An enforcement notice is issued where the responsible person has failed to comply with the legislation and details corrective measures that they are legally obliged to complete within a set timescale, to comply with the law.

#### *Prohibition notice*

A prohibition notice is issued where the use of the premises may constitute an imminent risk of death or serious injury to the persons using them. This may be a restriction of use (e.g. imposing a maximum number of persons allowed in the premises), or a prohibition of a specific use of all or part of the premises (e.g. prohibiting the use of specific floors or rooms for sleeping accommodation).

#### *Prosecution*

If the problem is considered very serious or if any of the lesser actions have not been satisfied, the fire authority can initiate a prosecution with considerable fines or even imprisonment as a potential penalty.

### **The future of fire safety legislation**

The Government has conducted a detailed review of the effectiveness of current fire safety legislation. It has developed proposals for future improvements, which are presented in the form of a quick-read guide called *Building a safer future* and the final report from Dame Judith

Hackitt, *Building a Safer Future: Independent Review of Building Regulations and Fire Safety*.

The review focuses primarily on creating a stronger regulatory framework for high-rise, multi-occupancy residential buildings which were identified as areas of particular safety concerns. It sets out a new regulatory framework to address current weaknesses and concentrates on the need to strengthen regulatory oversight to create both positive incentives to comply with building safety requirements and to effectively deter noncompliance.

Legislation must clarify roles and responsibilities and raise and assure competence levels, as well as improving the quality and performance of construction products.

The report makes it clear that we must all play our parts in improving fire safety for emergency lighting.

Clients need to appreciate the risks to building occupants and ensure that they use competent engineers to assist them in minimizing those risks. Identifying the client's responsibilities at the outset will ensure a greater degree of ongoing engagement.

Principal project designers should maintain the ownership concept on behalf of the client to ensure that important safety points are observed and key players are engaged appropriately and are co-operating in the interface of the various safety systems.

Emergency lighting designers should ensure accountability and help to create an audit trail in respect of any design changes that can be followed back through the principal designer and ultimately to the client.

Principal contractors should assume primary ownership throughout the construction phase, and especially at handover to the occupation and maintenance phase.

Emergency lighting contractors should ensure the required design is correctly installed and help to create an audit trail to ensure that any on-site changes can be followed back through the principal contractor and ultimately to the client.

As an industry we need to support the drive for increased safety.

Manufacturers need to ensure they offer high quality products that meet the latest product standards and users should be provided with sufficient accurate design information to enable them to be applied correctly.

Designers need to be able to consult with clients and they must be competent to match the system they design to the client's needs. The design should then be established and sufficient information passed to the installer to ensure the system is fitted as required.

The installer must be competent to take the designer's information and produce the required installation. They need to be able to appreciate any site problems that may occur and ensure they are dealt with correctly and that any changes needed are accepted by the designer.

The maintenance engineer must be trained and capable of keeping the system tested and repaired. If needed they should also be able to assess the impact of any changes to the building or its use and refer them back to a designer for consideration.

Two documents have recently been published that will assist with the actions recommended in the report. BS 7273-6:2019, *Code of practice for the operation of fire protection measures – Part 6: Fire detection and fire alarm systems – Interface with ancillary systems and equipment*, advises on the interface of different fire safety systems. PD CEN/TS 17165:2018, *Light and lighting – Lighting system design process*, details the responsible persons for all lighting system installations.

The Hackitt report makes many references to the need for engineers involved with the provision, design installation and maintenance of all safety systems to be competent. This is particularly true now as we operate by engineering systems to match specific risks. To provide the required level of competence, it is advisable that engineers should have appropriate training to give them the necessary knowledge of and experience in emergency lighting. They will also need suitable equipment such as calibrated meters, computer programs and access to relevant documentation and standards.

## Definitions

To be able to interpret standards and guidance documents correctly, it is important to understand the meaning of the major terms used in the industry. Unfortunately, not all the definitions in the standards are consistent or easily understood. So the following list gives a basic meaning for each term. These definitions are intended to give an understanding of the terms. If full technical details are needed they are printed in the relevant standards.

### **'A' national deviation**

Within European Standards, countries are allowed 'A' deviations to contract out of sections of the standard if they have national legislation that has different requirements. All of these deviations are listed in that standard for each country, so that any engineers working there know the relevant requirements.

**ballast**

The control circuit that controls the operation of a fluorescent lamp from a specified AC or DC source (typically in the range 2.4–240 V). It can also include elements for starting the lamp and ensuring that for power factor correction or radio frequency interference suppression requirements can be met.

**ballast lumen factor (BLF)**

The ratio of the light output of the light source when the ballast under test is operated at its design voltage, compared with the light output of the same light source operated with the appropriate reference ballast supplied as its rated voltage and frequency.

**battery**

A secondary cell providing the source of power during mains failure.

**battery capacity**

The discharge capability of a battery, which is a product of the average current and time, expressed as ampere hours over a stated duration.

**battery sealed (recombination)**

A battery that is totally sealed or constructed so that no provision is made for the replacement of the electrolyte.

**battery unsealed (vented)**

A battery that requires replacement of the electrolyte at regular intervals.

**borrowed light**

The assistance from borrowed light is clarified in that when it comes from an adjacent emergency light this is acceptable. However, other sources such as street lighting are increasingly being switched off for energy saving, so they should not be relied on in a new installation. If an existing installation relied on another source then it should be reassessed as part of the regular revisions of the fire risk assessment. In case of doubt, additional emergency luminaires are recommended.

**central power supply system**

A system with a single battery and charger supplying a number of remote emergency luminaires.



### **combined emergency luminaire** (previously known as sustained)

Contains two or more lamps at least one of which is energized from the emergency supply and the remainder from the normal supply. The lamp energized from the emergency supply in a combined emergency luminaire is either maintained or non-maintained.

### **competent person**

Is someone with the relevant current training and experience, with access to the requisite tools, equipment and information so they are capable of carrying out the required tasks.

### **design voltage**

The voltage declared by the manufacturer to which all the ballast characteristics are related.

### **deviation**

If the designer or installer deviates from the requirements of the code of practice, he or she has to identify the reasons for the deviation and demonstrate that the safety of the building is not impaired in this particular application. All relevant parties must be notified and the details must be recorded in the completion certificate.

### **emergency ballast lumen factor**

Ratio of the emergency luminous flux of the lamp supplied by the emergency control gear to the luminous flux of the same lamp operated with the appropriate reference ballast at its rated voltage and frequency.

### **emergency exit**

A way out that is intended to be used any time that the premises are occupied.

### **emergency luminaire rated luminous flux**

Lumen output as claimed by the luminaire manufacturer, 60 s (0.5 s for high risk task area luminaires) after failure of the normal supply, and continuously maintained to the end of rated duration of operation.

### **F mark**

This mark used to show that the luminaire could be mounted on combustible surfaces. It is no longer needed as all emergency luminaires should be suitable for that location. It does not show that the luminaire is fire retardant.

**final exit**

The terminal point of an escape route from the building

NOTE This may not be the final place of safety.

**illuminance**

The luminous flux density at a surface, i.e. the luminous flux incidence per unit area. The unit of illuminance is the lux (lx), which is the number of lumens per square metre on the surface being illuminated.

**luminaire**

Is the technical term for a light fitting that distributes, filters and transforms the lighting provided by the light source and includes all the items necessary for fixing and protecting these light sources and for connecting them to the supply circuit. It should be noted that internally illuminated signs are a special type of luminaire.

**maintained emergency luminaire**

A luminaire containing one or more light sources that operate from both the normal supply and from the emergency supply as available. It should be illuminated at all material times.

**material time**

This is the relevant time that protection should be available for. It commonly refers to the time that maintained exit signs need to be illuminated for, the material time being when the building is occupied.

**mounting height**

The vertical distance between the luminaire and the working plane. It should be noted that the floor is taken to be the working plane for emergency escape route lighting.

**non-maintained emergency luminaire**

A luminaire containing one or more light sources which operate from the emergency supply only upon failure of the normal mains supply.

**normal lighting**

All permanently installed artificial lighting operating from the normal electrical supply that, in the absence of adequate daylight, is intended to be able to be used at any time that the premises are occupied.

### **place of safety**

A safe area beyond the premises where relevant persons are no longer at risk from fire.

### **practical emergency lamp flux**

Minimum luminous flux of the lamp observed during the rated duration of the emergency mode.

### **rated duration**

The manufacturer's declared duration, specifying the time for which the emergency lighting will provide the rated lumen output after mains failure. This may be for any reasonable period, but is normally one or three hours.

### **rated load**

The maximum load that may be connected to the system and supplied for the rated duration.

### **recharge period**

The time necessary for the batteries to regain sufficient capacity to achieve their rated duration.

### **remote inhibiting facility**

Means for remotely inhibiting a luminaire associated with an emergency lighting system.

### **remote inhibiting mode**

State of a self-contained emergency luminaire which is inhibited from operating by a remote device while the normal supply is on and, in the case of a normal supply failure, the luminaire does not change over to emergency mode.

### **rest mode**

State of a self-contained emergency luminaire that has been intentionally extinguished while the normal supply is off and that, in the event of restoration of the normal supply, automatically reverts to normal mode.

**self-contained emergency luminaire or single-point luminaire**

A luminaire or sign providing maintained or non-maintained emergency lighting in which all the elements, such as the battery, the light source and the control unit, are contained within the housing or within one metre of the housing.

**slave or centrally supplied luminaire**

An emergency luminaire without its own batteries designed to work with a central battery system.

**850 °C glow wire test**

Enclosures of batteries of emergency luminaires must pass this test as specified in BS EN 60598-2-22. This test protects the battery circuits so that internal circuit faults will not set fire to the luminaire.