

Emergency Lighting Design Guide

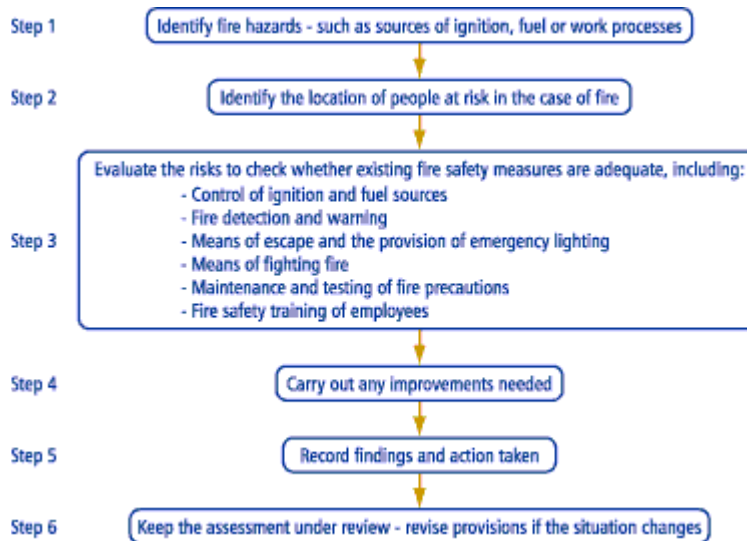
Legal Requirements

The main reason for installing an emergency lighting system is to enable the building to meet fire safety legislation in a way that is visually acceptable and meets the user's needs for ease of operation and maintenance. Consequently it is important to establish all the relevant legal requirements for emergency lighting and fire alarm systems before commencing the design these should ideally be agreed between the system designer, user, fire authority, building control officer and system installer.

The main legislative requirements are:

The Building Regulations 2000

These regulations detail the design and construction characteristics of a building. Approved Document B details the fire safety requirements for new buildings and the major refurbishment of existing premises. Table 9 of this document shows the locations that must be provided with emergency lighting. It now defines that in addition to escape routes, all open areas larger than 60m² must be illuminated in the event of the failure of the normal lighting supply. It also clarifies that emergency lighting is needed for all parts of schools that either do not have natural light or are used outside normal school hours. The regulations require that systems comply with BS 5266-1, the code of practice for emergency lighting.



The Fire Precautions (Workplace) Regulations 1997

This directive controls the way that the building will be used and the equipment and systems needed to safeguard the occupants. The legal requirement is that - "Emergency routes and exits requiring illumination must be provided with emergency lighting of adequate intensity in case the lighting fails". The law is explained and the rules for compliance are given in a joint Home Office and Health & Safety Executive document - "FIRE SAFETY - An employer's guide". Main points from the guide are:

- The employer has legal responsibility for compliance
- Although the legislation uses and modifies the Fire Precautions Act 1971, it now covers all premises where people are employed
- Any site with five or more employees must keep a formal record of Fire Risk Assessment. This

- should evaluate the site and detail the measures taken to ensure the safety of the premises
- If the premises already have a fire certificate to the latest standards the employer still needs to provide a risk assessment, but it is unlikely that they will need any additional equipment. If however the fire certificate was issued prior to 1999, when BS 5266-1 was revised, the risk assessment needs to check whether improvements are needed to meet the latest standard

From this directive there are a number of points that are of major importance to emergency lighting system design.

- The evaluation of areas with a fire risk assists when deciding which areas need protection, e.g. a school chemical laboratory may be smaller than 60m² but still need emergency lighting, as combustible materials and sources of ignition would be present
- The assessment of the location of employees and any visitors to the site assist in determining the most appropriate escape routes
- The guidance to the directive gives detailed requirements for the suitability of escape routes and calls for the installation of emergency lighting to be in accordance with BS 5266-1
- It recommends that advice on the installation should be given by a competent person who specialises in emergency lighting systems
- Continued maintenance and testing must be correctly carried out, to comply with the directive
- The equipment used must be capable of being demonstrated as of adequate quality. Compliance with the appropriate British Standard, or other approved third party scheme, gives evidence of this. The standard for luminaires is BS EN 60598-2-22. ICEL 1001 registration endorses the spacing data of these luminaires. The standard for central battery systems is BS EN 50171

Note: When the premises are being assessed for risk, shortcomings in other areas of fire protection can be compensated for by improved levels of emergency lighting and fire alarms.

Compliance with BS5266-1:1999 is deemed to comply with these requirements.

The Health and Safety (Safety Signs and Signals) Regulations 1996

This regulation requires the adequate provision of signs protected by emergency lighting. It details that signs should be located at all final exits and also on the escape routes at any location where the route may be in doubt.

Other Requirements

In addition to fire safety legislation, some workplaces require a licence from the Local Authority, including theatres and cinemas, sport stadiums and premises for public entertainment, music, dancing, gambling and the sale of alcohol. Other premises must be registered with the Local Authority and be inspected by the Fire Authority, including nursing homes, children's homes, residential care homes and independent schools. Both licensed and registered premises have to pass a fire inspection to confirm that they have systems complying with BS 5266-1 for the emergency lighting and BS 5839 for fire equipment. Records of a system are now essential to maintain the validity of approvals and licences.

Emergency Lighting - System Design

This section provides guidance on system design to meet BS 5266 Parts 1 and 7: 1999 and so achieve compliance with legislation

Design Objective

BS 5266, when referring to the provision of Escape Lighting in section 4.2, requires that when the supply to all or part of the normal lighting in occupied premises fails, escape lighting is required to fulfil the following function:

- (a) To indicate clearly and unambiguously the escape routes.

- (b) To provide illumination along such routes to allow safe movement towards and through the exits provided.
- (c) To ensure that fire alarm call points and fire fighting equipment provided along escape routes can be readily located.
- (d) To permit operations concerned with safety measures.

BS 5266-1 recommends that discussions should be held prior to commencing the design, to establish the areas to be covered, the method of operation, the testing regime and the most suitable type of system. These discussions should include the owner or occupier of the premises, the system designer, the installer, the supplier of the equipment and the fire authority.

Note: BS5266 will be revised during 2004 following the publication of EN50172. Visit the British Standards Institute website, at www.bsi-global.com for the latest information.

STAGE 1

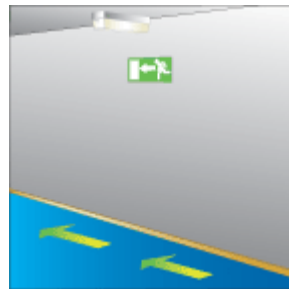
LOCATE LUMINAIRES AT MANDATORY “POINTS OF EMPHASIS”

Initial design is conducted by situating luminaires to reveal specific hazards and highlight safety equipment and signs, in addition to providing illumination to assist safe travel along the escape route. This should be performed regardless of whether it is an emergency escape route or an open (anti-panic) area. Only when this is accomplished should the type of luminaire or its light output be considered. BS5266 Pt 7: 1999 requires that the luminaires sited at points of emphasis must comply with BS EN 60 598-2-22.

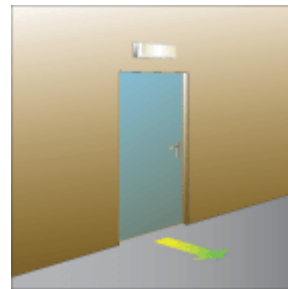
Specific locations where a luminaire must be provided are:



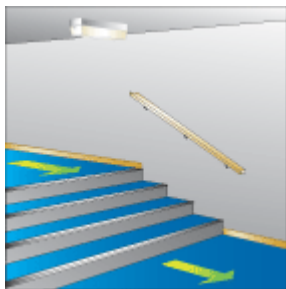
At each exit door



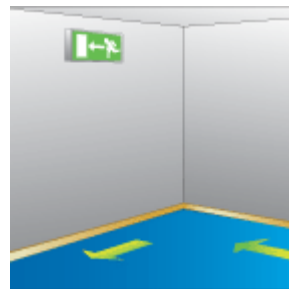
All safety exit signs



Outside and near each final exit



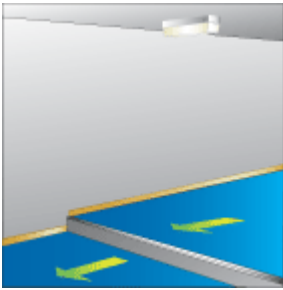
Near stairs so that each tread receives direct light



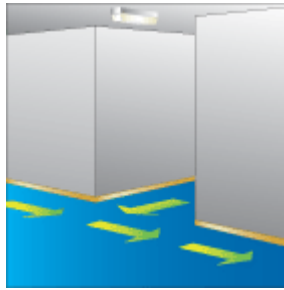
At each change of direction



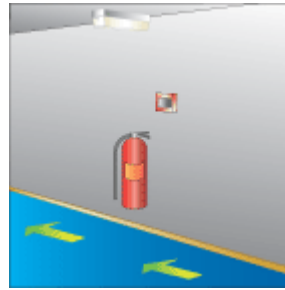
Near each first aid post



Near any other change of floor level



At each intersection of corridors



At each piece of fire fighting equipment and call point

Note - the term near means within 2 metres measured horizontally

STAGE 2

ENSURE THAT EXIT SIGNS ARE OF CORRECT FORMAT AND SIZE

Section 4.1 of BS5266 Pt 7 states that "Signs which are provided at all exits intended to be used in an emergency and along escape routes shall be illuminated to indicate unambiguously the route of escape to a point of safety". Where direct sight of an emergency exit is not possible, an illuminated directional sign (or series of signs) shall be provided to assist progression towards the emergency exit.

• Sign formats should not be mixed



BS2560: 1975

Old-style signs now obsolete. Should have been replaced by December 1998



BS 5499 Pt 1

Signs are still acceptable, if they are already in the building



European Signs Directive Format

This came into force on 1st April 1996, under The Signs Directive

If there is any doubt as to the most appropriate format of sign, guidance should be obtained from the local Fire Authority.

• Maximum viewing distances

For all format of safety signs the maximum viewing distances and luminance conditions are given in BS 5266 pt7/EN 1838 Signs can be either internally illuminated, such as exit boxes or edge lit emergency luminaires with a screened sign that have a controlled illuminance, or painted signs with an external emergency light illuminating them. Maximum viewing distances are:

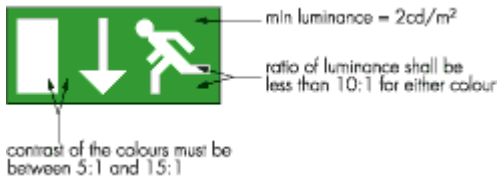
Internally illuminated signs - 200 x the panel height

Externally illuminated signs - 100 x the panel height



• Illumination requirements

The sign must conform to the colours of ISO 3864, which defines that exit and first aid signs must be white with green as the contrast colour. The ratio of luminance of the white colour to the green colour must be between 5:1 and 15:1. The minimum luminance of any 10mm patch area on the sign must be greater than 2cd/m^2 and the ratio of maximum to minimum luminance shall be less than 10:1 for either colour



Note: Internally illuminated exit signs are pre-tested to ensure they meet these requirements, provided that they comply with EN 60598-2-22.

If the sign is designed to be externally illuminated, considerable care must be taken by the system designer to see that these conditions are met. Even though an emergency luminaire must be sited within 2 metres from the sign (see stage 1) calculations should still be made to check that the sign is adequately illuminated.

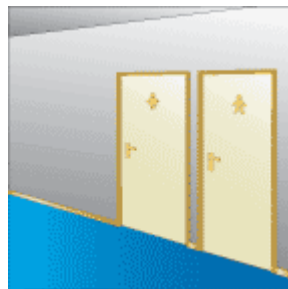
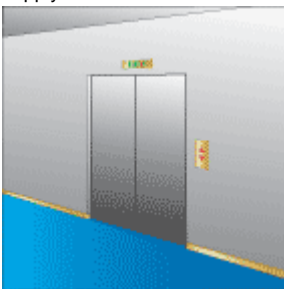
STAGE 3

LOCATE LUMINAIRES AT THE FOLLOWING ESSENTIAL AREAS IN THE BUILDINGS

Locate luminaires at the following essential areas in the buildings.

These locations are not part of the escape route but because of their risk they require protection by emergency lighting.

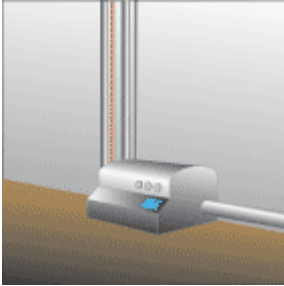
- a) Lift cars - although only in exceptional circumstances will they be part of the escape route, do present a problem in that the public may be trapped in them in the event of a supply failure.
- b) Toilets - all toilets for the disabled and facilities exceeding 8m^2 floor area or without borrowed lights.
- c) Escalators - to enable users to get off them safely.



- d) Motor generator, control or plant
- e) Covered car parks - the normal

rooms - require battery supplied emergency lighting to assist any maintenance or operating personnel in the event of failure.

pedestrian routes should be provided with non-maintained luminaires of at least 1 hour duration.



STAGE 4 ESCAPE ROUTE LIGHTING

When the points of emphasis have been covered, it is essential to provide any additional luminaires to ensure that minimum illuminance levels are met to enable the routes to be used safely. In addition, every compartment on the escape route must have at least two luminaires, to provide some light in the event of luminaire failure.

• Light Level Requirements

BS 5266 Pt 7: 1999 (EN1838) calls for a minimum of 1 lux anywhere on the centre line of the escape route for normal risks. A uniformity ratio of 40:1 maximum to minimum must not be exceeded. This illuminance must be provided for the full duration and life of the system. 50% of the illuminance must be available within 5 seconds and the full value within 60 seconds of supply failure.

Note: The UK has an "A deviation" which continues to allow a 0.2 lux minimum value for routes that will be permanently unobstructed. It should be noted that this puts a heavy burden on the user to ensure routes are kept clear even in an emergency. For this reason it is recommended that the 1 lux level should always be used.

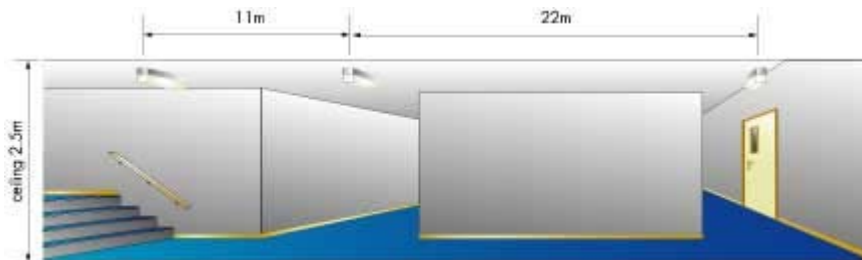










• Photometric Design

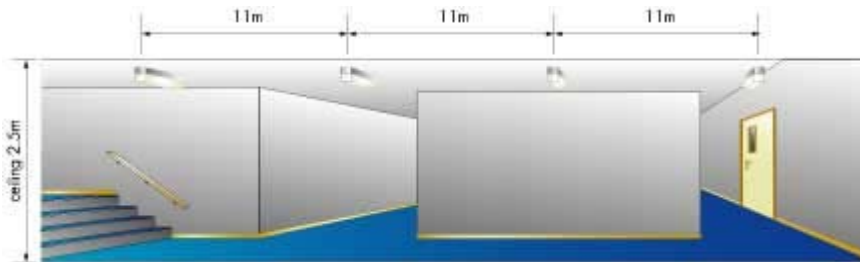
Emergency Escape Routes

The use of spacing tables or a suitable computer program provides the information to determine whether luminaires are needed in addition to those for the points of emphasis (see data section), to provide the minimum required level of illumination on the escape routes. To ensure that the design will meet the required levels at all times the data is derated, as required by the standard, to cover the following factors:

- i. Reduction in light as the battery voltage reduces during discharge.
- ii. Aging of lamps in maintained circuits
- iii. The effects of dirt (Spacing tables use a figure of 80%).



Britelite			Escape route 2m wide 1 lux min				Open (anti-panic) area 0.5 lux min			
Luminaire type	Mounting height (m)	Lux level directly under								
Self-contained										
NM	2.5	3.28	3.9	11.3	4.0	2.0	4.0	12.0	6.0	1.9
	4.0	1.28	2.1	9.6	5.6	1.2	3.3	14.8	7.2	1.9
	6.0	0.57	-	-	-	-	1.6	12.4	7.4	0.8
M	2.5	2.75	3.3	10.7	5.2	1.8	3.7	11.7	5.8	1.8
	4.0	1.07	1.5	8.0	5.0	0.7	3.5	14.2	7.0	1.7
	6.0	0.48	-	-	-	-	-	-	-	-



STAGE 5 OPEN (ANTI-PANIC) CORE AREAS

Areas larger than 60m², open areas with an escape route passing through them, or hazards identified by the building risk assessment all require emergency lighting. The current standard is easy to design for and to verify, promoting systems that provide good uniformity rather than ones that use a few large output luminaires.

• Light Level Requirements

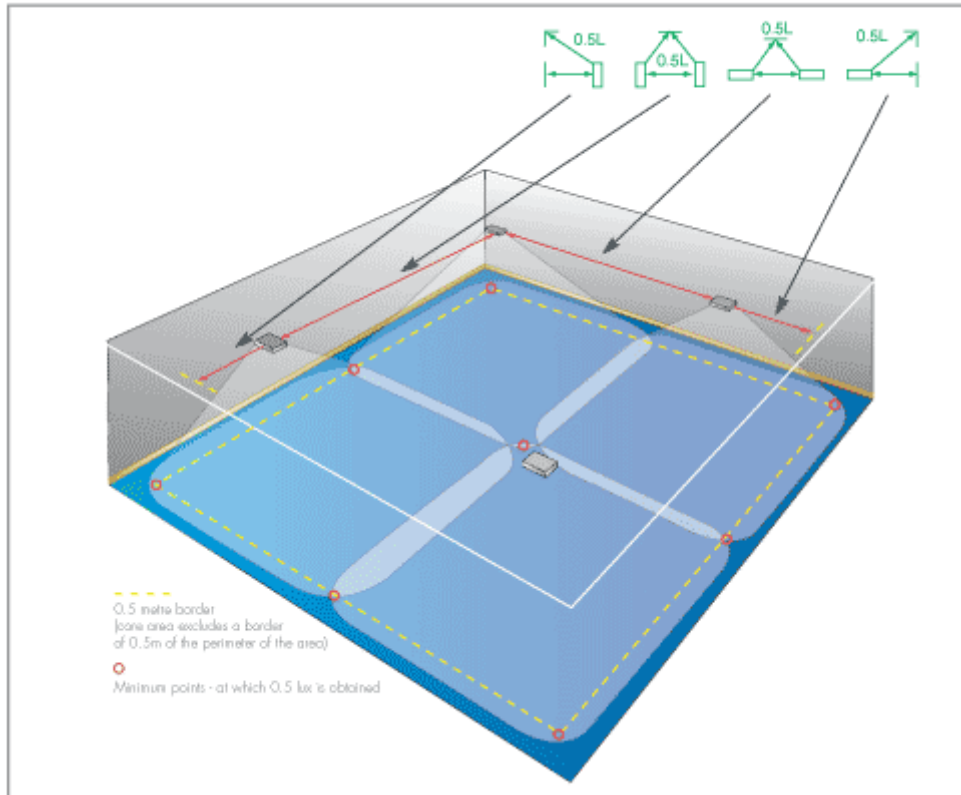
BS5266 Pt 7/EN1838 - 4.3 calls for 0.5 lux minimum of the empty core area, which excludes a border of 0.5m of the perimeter of the area. Spacing tables or a suitable computer program provide simple and accurate data that can easily be used. The spacing tables for 0.5 lux are de-rated on the same basis as those for escape routes. They can also be used as a guide for initial selection of the location of luminaires when using a computer program

• Spacing data

Specific data is available for self-contained dedicated emergency luminaires. This can be found in this design guide section by following the link to [Emergency Lighting Spacing Tables](#) (pdf document).

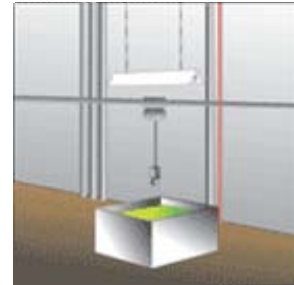
If using standard mains luminaires fitted with an emergency conversion kit, typical data is also shown in the spacing table document. The data details the polar distribution for common types of luminaires, from which a suitable match should be selected. The factors considered should be the shape of the polar curve and the scale, which is shown by the nadir intensity. Alternatively, a computer program can be used and the light outputs of the appropriate kit can be used with the actual distribution data of the luminaire chosen.

Luminaire spacing in open (anti-panic) core areas



STAGE 6 HIGH RISK TASK AREA LIGHTING

Areas of high physical risk, or the control rooms of dangerous plant and production lines, need emergency lighting to enable them to be shut down safely. BS5266 Part 1: 1999 defines that emergency lighting should provide 10% of the normal lighting level at the hazard, with a minimum of 15 Lux. (In practice this minimum is unlikely ever to be a problem, as it would only be valid if the risk area had a normal illumination level less than 150 lux).



DESIGN PROCEDURES

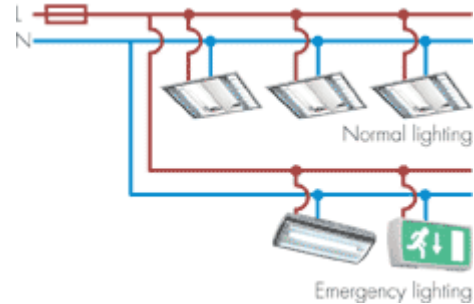
Reaching the light levels needed would normally be achieved by using a conversion of the normal luminaire, or by using a tungsten projector unit. If conversion units are selected, a direct ratio can be obtained by the Ballast Lumen Factor (BLF). i.e. to achieve 10% of normal use either:

- Emergency units with a BLF of 10% are needed for each fitting in the area
 - Emergency units with a BLF of 20% are needed for every other fitting
 - Emergency units with a BLF of 100% are needed for one in 10 fittings
- Care is needed to ensure that a reasonably uniform distribution is achieved by whatever combination of luminaire and conversion kit used. If tungsten projector units are selected, a co-efficient of utilisation calculation has to be performed for the required value.

STAGE 7 CONTROL

Non-maintained luminaires must be activated by failure of supply to the normal lighting. They must therefore be connected an unswitched live taken from the local normal lighting final circuit.

Once the design has been completed it becomes apparent that the performance of the luminaire depends as much on the light distribution as it does the light output available. Consequently it becomes essential that luminaire types specified for a particular design do not get changed without a re-appraisal of the photometric design.



TESTING AND LOG BOOK

The Fire Precautions (Workplace) Regulations 1997 require that appropriate testing is performed to maintain compliance of the system. The system should include adequate facilities for testing and recording the system condition. These need to be appropriate for the specific site and should be considered as part of the system design. Discussions with the user or system designer should identify:

- The calibre and reliability of staff available to do the testing
- The level of difficulty in performing the test
- If discharge tests need to be done outside normal working hours, or phased so only alternate luminaires are tested in buildings that are permanently occupied

The testing requirements in the code of practice are:

• Function test

All emergency luminaires should be tested by breaking the supply to them and checking that they operate satisfactorily.

The supply must then be restored and the charging indicators must be seen to be operating correctly. This test must be performed at least once per month and the results logged

• Discharge test

The luminaires must be tested for their full rated duration period and checked for satisfactory operation. The supply must then be restored and the charging indicators rechecked. This test must be performed at least annually and the results logged

Note: BS 5266-1: 1999 allows a one hour test to be performed as an alternative every six months for the first 3 years of the system, but the guidance document to the Fire Precaution Regulations calls for the annual test at all stages of equipment life.