

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:

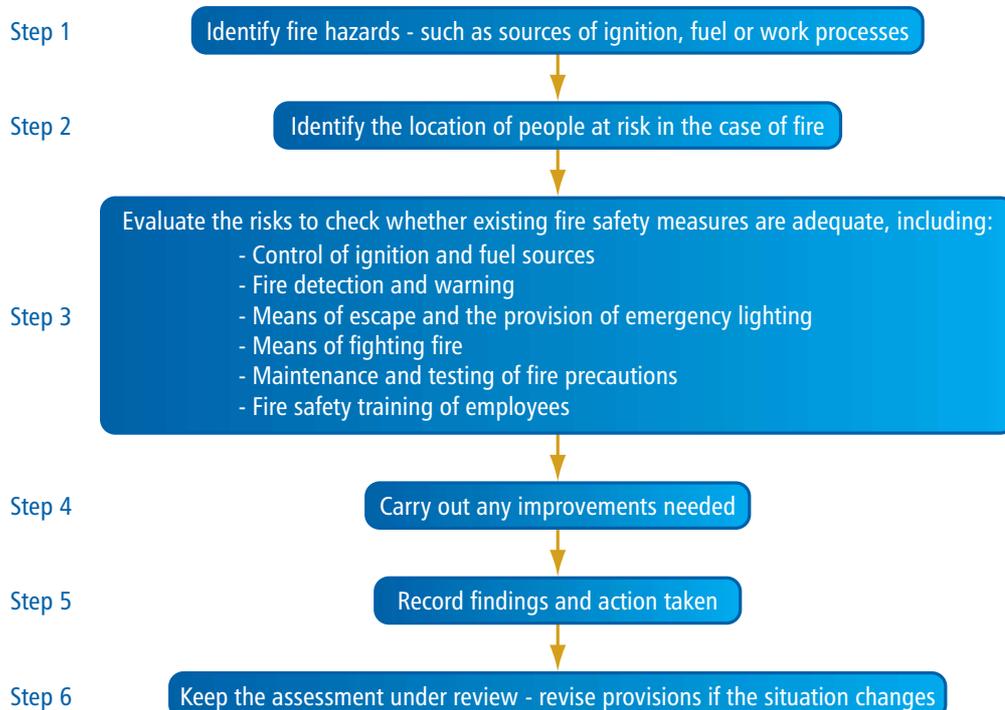
THE BUILDING REGULATIONS 2000

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



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THE FIRE PRECAUTIONS (WORKPLACE) REGULATIONS 1997 (cont'd)

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. For up to date information visit our website at www.cooper-ls.com. Alternatively visit the British Standards Institute website, at www.bsi-global.com

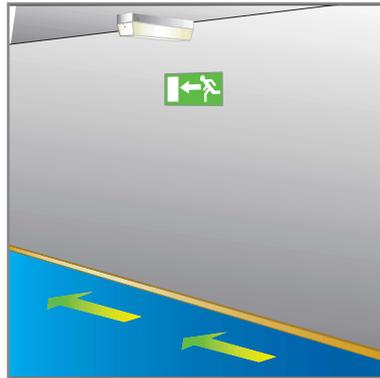
STAGE 1**LOCATE LUMINAIRES AT MANDATORY "POINTS OF EMPHASIS"**

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.

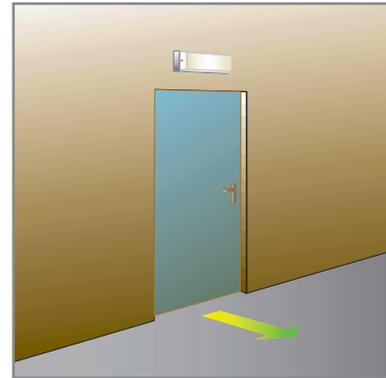
Specific locations where a luminaire must be provided are:



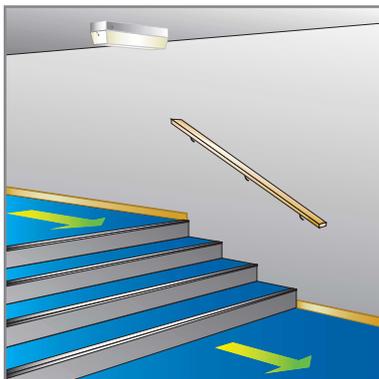
At each exit door



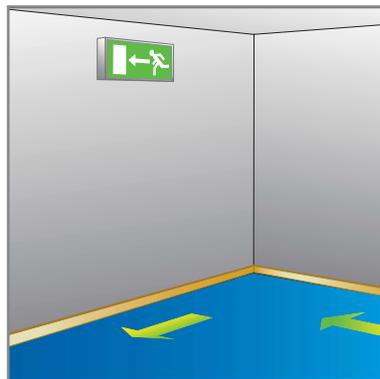
All safety exit signs



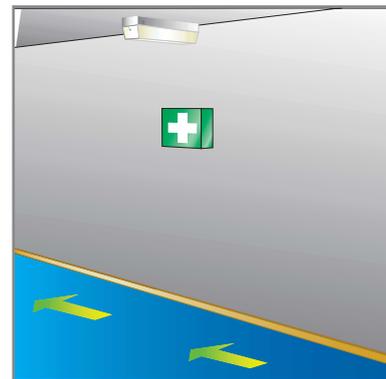
Outside and near each final exit



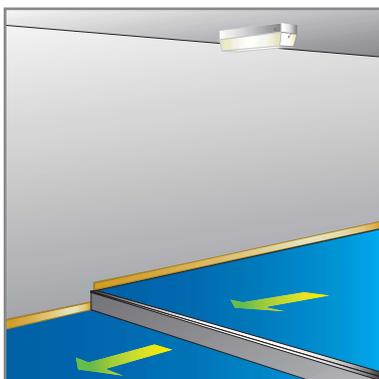
Near stairs so that each tread receives direct light



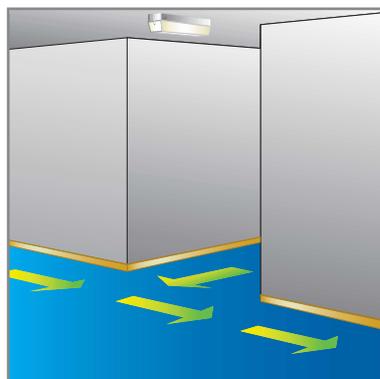
At each change of direction



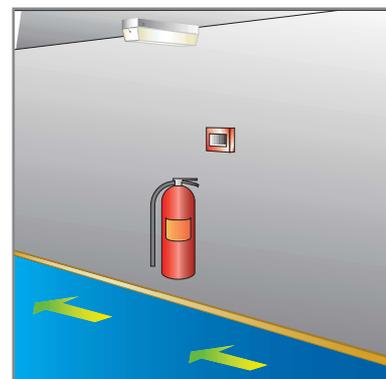
Near each first aid post



Near any other change of floor level



At each intersection of corridors



Near each piece of fire fighting equipment and call point

Note - the term near means within 2 metres measured horizontally

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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

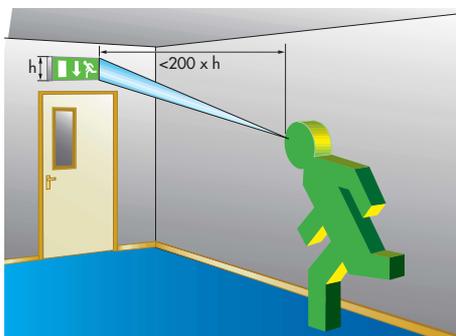


If there is any doubt as to the most appropriate format of sign, guidance should be obtained from the local Fire Authority.

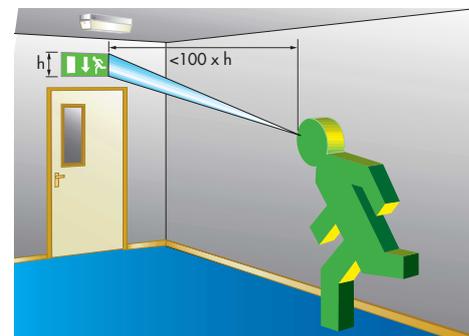
- **Maximum viewing distances**

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 - $200 \times$ the panel height

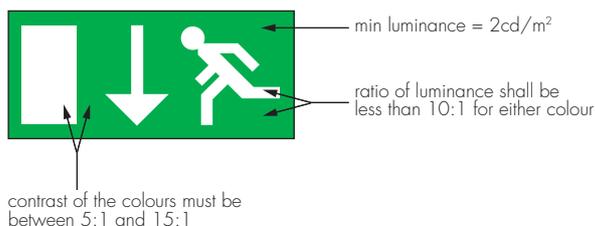


Externally illuminated signs - $100 \times$ the panel height



- **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 $2\text{cd}/\text{m}^2$ 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.

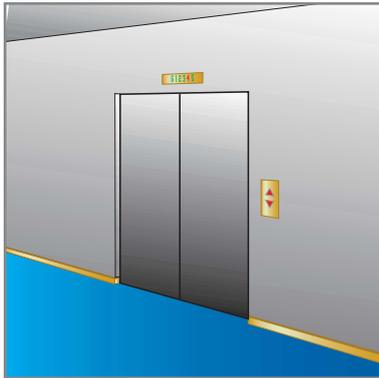
STAGE 3

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.

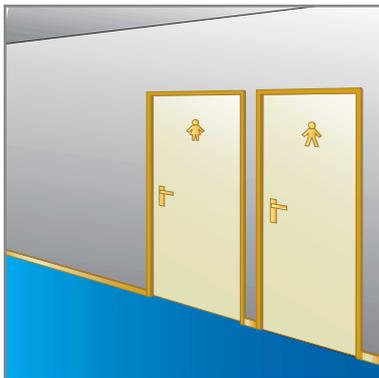


- c) Escalators - to enable users to get off them safely.

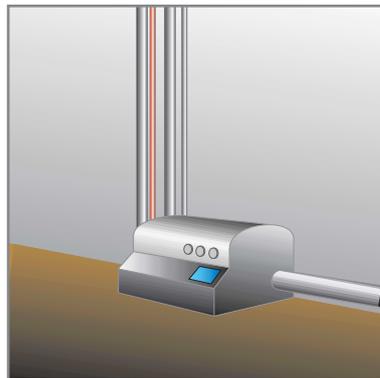


- e) Covered car parks - the normal pedestrian routes should be provided with non-maintained luminaires of at least 1 hour duration.

- b) Toilets - all toilets for the disabled and facilities exceeding 8m² floor area or without borrowed lights.



- d) Motor generator, control or plant rooms - require battery supplied emergency lighting to assist any maintenance or operating personnel in the event of failure.



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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 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

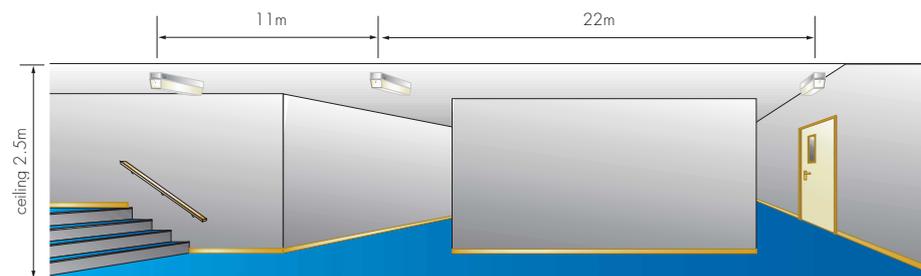
The use of spacing tables or a suitable computer program provides the information to determine whether luminaires are needed in addition to those for the points of emphasis (see data section), to provide the minimum required level of illumination on the escape routes. To ensure that the design will meet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

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

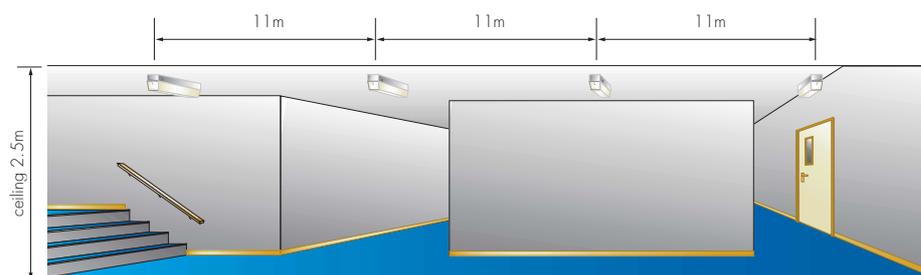
PHOTOMETRIC DATA

Luminaire type	Mounting height (m)	Lux level directly under	Escape route 2m wide 1 lux min				Open (anti-panic) area 0.5 lux min			
			Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5	Diagram 6	Diagram 7	Diagram 8
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	-	-	-	-	-	-	-	-

Example - luminaire spacing along escape route



Locate luminaires at mandatory "Points of emphasis"



Add additional luminaire to achieve 1 lux minimum

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**

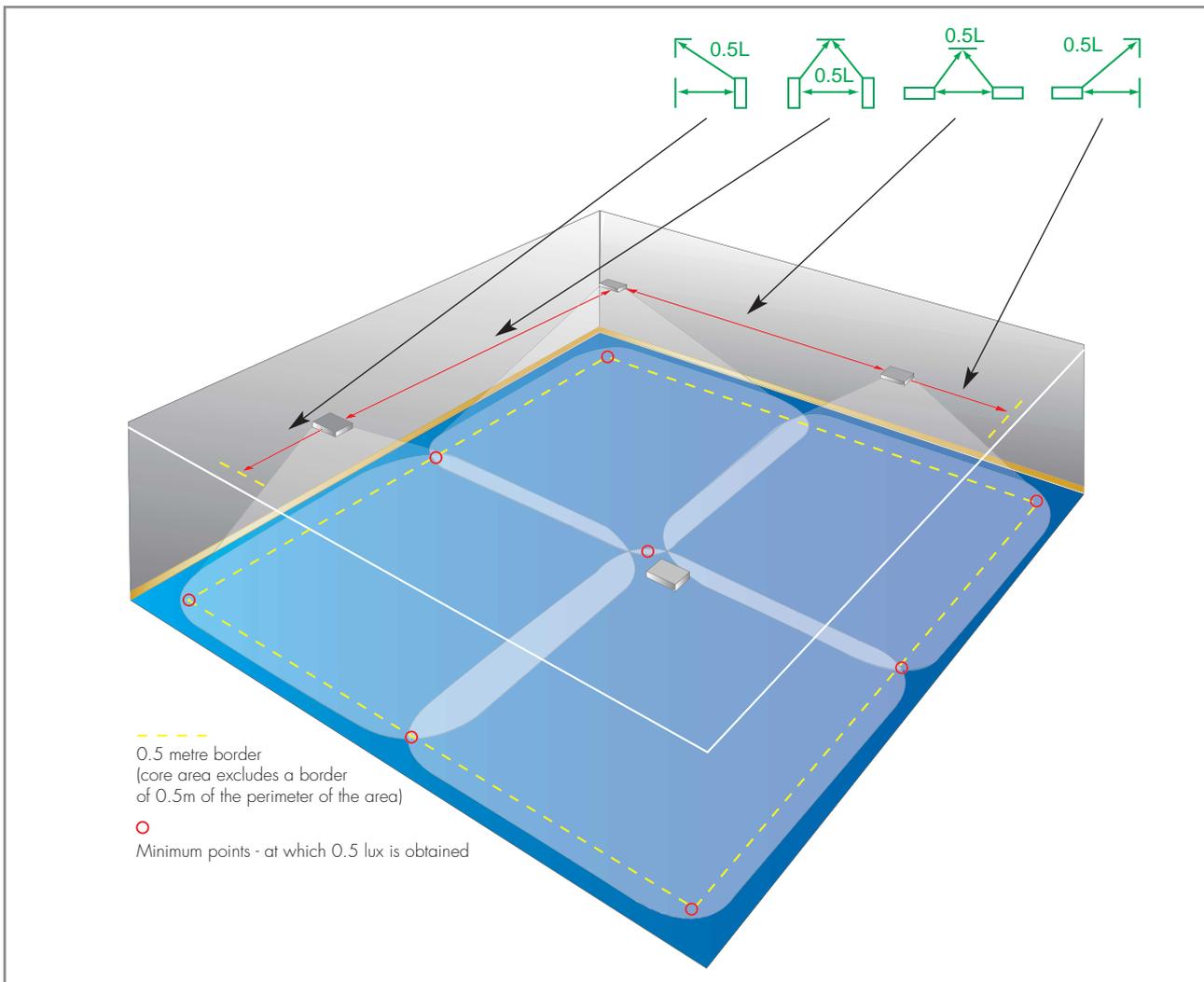
BS5266 Pt 7/EN1838 - 4.3 calls for 0.5 lux minimum of the empty core area, which excludes a border of 0.5m of the perimeter of the area. Spacing tables or a suitable computer program provide simple and accurate data that can easily be used. The spacing tables for 0.5 lux are de-rated on the same basis 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 on each of the individual product entries in this catalogue and repeated in the section after this design guide.

If using standard mains luminaires fitted with an emergency conversion kit, typical data is shown on pages 456-459. 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



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STAGE 6

HIGH RISK TASK AREA LIGHTING

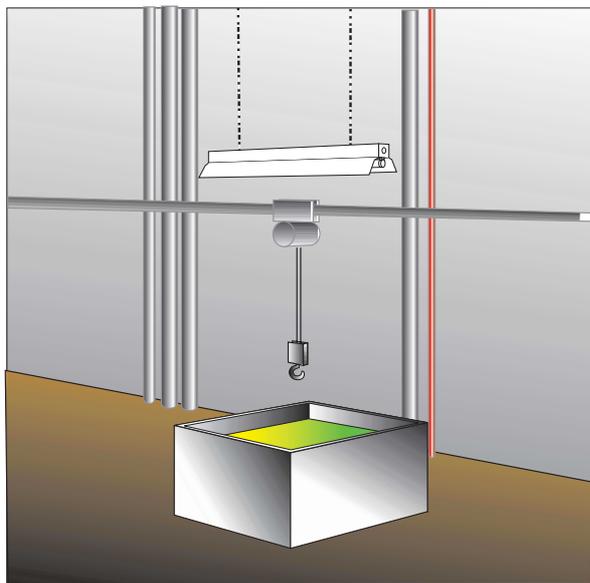
Areas of high physical risk, or the control rooms of dangerous plant and production lines, need emergency lighting to enable them to be shut down safely. BS5266 Part 1: 1999 defines that emergency lighting should provide 10% of the normal lighting level at the hazard, with a minimum of 15 Lux. (In practice 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 coefficient of utilisation calculation has to be performed for the required value.

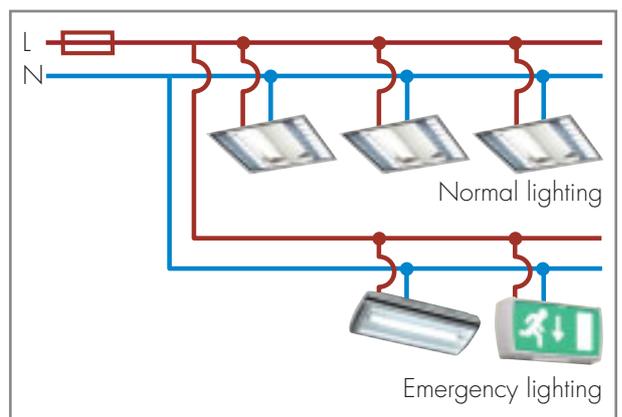


STAGE 7

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.

STAGE 7 (cont'd)

MANUAL TESTING

If manual testing is utilised, the following points should be considered:

- Is a single switch to be used? Unless the whole building is to be switched off, a separate switch should be used for each final circuit. As the feed to non-maintained circuits must be taken from the switch this will probably mean that the building will have to be walked around twice, once to check the luminaires and once to check that they are recharging
- Are luminaires to be individually switched? In practice, only a single walk around the building will be needed. However, the test switches could spoil the décor of the building and they must be of a type that is tamper proof.

After the tests, the performance of the luminaires must be logged.

COMMISSIONING CERTIFICATE

BS5266 Pt 1: 1999 and the European Standard both require written declarations of compliance to be available on site for inspection. These consist of:

1. Installation quality.
IEE regulations must have been conformed with and non-maintained fittings fed from the final circuit of the normal lighting in each, as required in BS 5266
2. Photometric performance.
Evidence of compliance with light levels has to be supplied by the system designer. Photometric tests for Cooper Lighting and Security luminaires are performed at BSI and spacing data is registered by the ICEL scheme. Therefore copies of the spacing data in this catalogue provide the verification required.
3. Declaration of a satisfactory test of operation.
A log of all system tests and results must be maintained. System log books, with commissioning forms, testing forms and instructions are available from Cooper Lighting and Security.

MAINTENANCE

Finally, to ensure that the system remains at full operational status, essential servicing should be defined. This normally would be performed as part of the testing routine, but in the case of consumable items such as replacement lamps, spares should be provided for immediate use.

AUTOMATIC TEST SYSTEMS

If the costs of an engineer time and the disruption caused by manual testing are excessive, automatic systems should be considered. Different formats are available to match particular site requirements. Cooper Lighting and Security offer two alternative testing systems:

- EasiCheck™
Particularly suited to medium to large sized installations, EasiCheck™ is a versatile addressable emergency lighting system that uses a central control panel to perform automatic test schedules, initiate manual tests and download event logs and test reports. It is available for use with both self-contained luminaires and central power systems. EasiCheck™ continuously monitors the emergency circuit, reporting faults as soon as they occur. Up to 63 panels can be networked together, ensuring EasiCheck can be utilised in the largest of projects of up to 15,750 emergency luminaires. It also has advanced software options for PC monitoring and control.



EasiCheck™ Panel

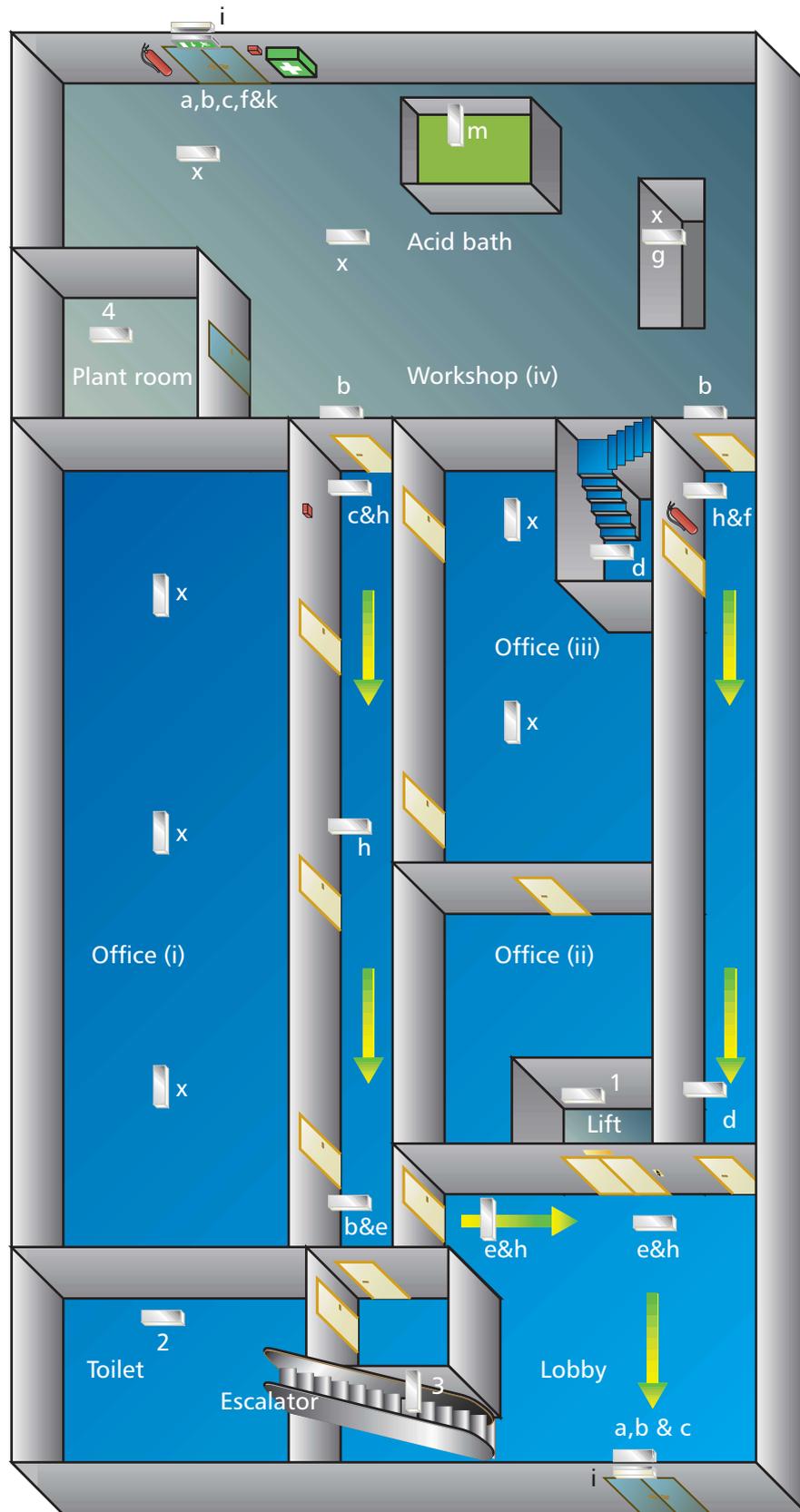


Intellem Programmer

- Intellem
Designed for use with self-contained emergency luminaires, Intellem is a stand alone self-test system for small to medium sized installations. Intellem is available in two options. In the basic format, Self Check, the testing module self calibrates and carries out testing at predetermined intervals. Faults are precisely reported by an audible alarm and the flashing sequence of the LED indicator. The enhanced Intellem Infra-Red option adds the benefits of flexible test set up, luminaire status interrogation and initiation of manual tests, all via a hand held programmer. Both options also continuously monitor the emergency luminaires, reporting faults as soon as they occur.

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EXAMPLE OF SYSTEM DESIGN



EXAMPLE OF SYSTEM DESIGN

Stage 1

Locate luminaires at points of emphasis on escape route

- a At each exit door
- b To illuminate exit and safety signs
- c Near call points (some covered by a.)
- d Near each staircase
- e Change of direction (covered by b.)
- f Near fire fighting equipment (covered by a.)
- g Change of floor level
- h Near intersection of escape routes
- i Outside final exits
- k Near first aid points

Stage 2

Exit sign location is covered by Stage 1, but it is important to check that maximum viewing distances are not exceeded and that if the normal lighting is dimmed, e.g. in cinemas, the exit signs must be permanently illuminated while the building is occupied (maintained lighting).

Stage 3

Other areas, which require emergency lighting but are not on the escape route area.

- 1 Lift car
- 2 Toilet (above 8m² floor area)
- 3 Escalators
- 4 Plant room

Stage 4

Check minimum illuminance levels on the escape routes. After selecting a suitable luminaire, e.g. Britelite, consulting the spacing table shows the number of fittings needed to provide a minimum of 1 lux on the centre line of the escape routes.

Stage 5

Anti-panic open areas (x) apply to any areas over 60m² floor area, or that have an escape route passing through them.

- (i) Office over 60m²
 - 3 x Britelite
- (ii) Office under 60m²
 - no requirement
- (iii) Under 60m², but part of escape route from office (ii)
 - 2 x Britelite fittings, either as compartment of escape route or an open anti-panic area
- (iv) Workshop 4m high
 - 3 x Britelite + 1 x DQX - 5 cell conversion unit for high risk (m) or 4 x DQX - 5 cell conversion units (Use of conversion units is dependent on suitable mains luminaires being used).

Stage 6

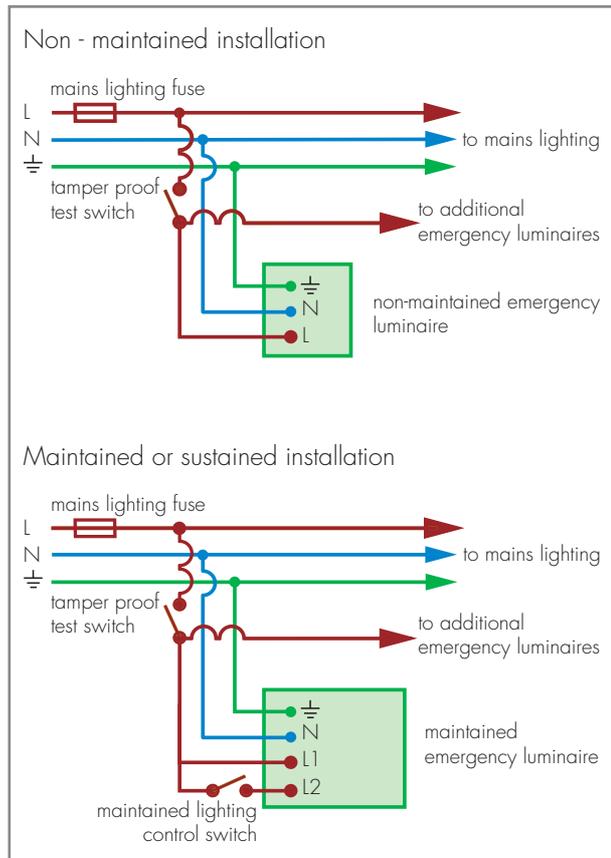
High risk lighting requirement for an acid bath (m) is included in the design for stage 5. If a conversion of a mains luminaire is not suitable, a high power tungsten projector, such as Beamlite could be used instead.

WIRING INSTALLATION

The wiring of emergency luminaires should generally be in accordance with normal wiring practice (I.E.E. Wiring Regulations), statutory requirements applicable to the type of building, local by-laws and regulations. The supply for self contained luminaires should be taken from the unswitched local light source

Cabling used when installing self-contained emergency luminaires should be of a similar type to that used for the normal mains light. In the event of a fire, if the cabling used for the emergency luminaires has greater protection, there may be a chance of the normal lighting failing and the emergency lighting remaining in the normal mode (i.e. inoperative). Hence it is recommended that self-contained emergency luminaires are wired in PVC insulated cable.

The supply to self-contained luminaires should be such as to prevent unauthorised disconnection, but should incorporate suitable means for simulating a mains failure for test purposes. The source of supply should be from the same local fuse as the normal lighting, so that in the event of a fuse failure causing the normal lighting to be extinguished, the emergency lighting is brought into operation in the same locality.



Wiring details