THORN

Emergency Lighting Design Guide

The application of emergency lighting

This design guide will help you to plan and implement an emergency lighting installation that satisfies all the legal requirements and ensures safe evacuation in the event an emergency.

Specific requirements for emergency lighting are set out in law. The individual responsible for the building must ensure that people can safely leave the premises when the mains power fails.

This evacuation is facilitated by an emergency lighting scheme that must comply with European laws. These laws dictate the level of lighting required in the event of an emergency, together with important obligations such as the visibility of exit signage and the response time of emergency luminaires.

Specific guidelines that refer to your country are detailed in the back of this guide.

What is emergency lighting?
Emergency lighting operates automatically when a lighting circuit loses the mains power supply.

Emergency lighting falls into two categories:

Escape lighting
This illuminates exit routes and open areas. These are defined in full on page 7. In summary:

- Exit routes must be clearly lit and signed to ensure people can evacuate the building safely.
- Open area lighting is designed to reduce confusion and panic, whilst ensuring visibility of the nearest exit route.

Escape lighting also enables employees to shut down sensitive or potentially dangerous processes before evacuating the building.

Standby lighting
Standby lighting allows normal activities to continue if the main lighting fails for any reason. An application such as an operating theatre or an air traffic control centre would require standby lighting.

Maintaining your emergency lighting scheme
Once an emergency lighting scheme is designed and installed, the person responsible for the building has a legal obligation to make sure that all the emergency luminaires will operate when required.

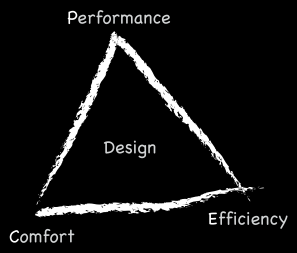
Emergency light fittings must be regularly tested to confirm that they will operate when required. These testing requirements are detailed in full on page 16.

As a pioneer in the field of emergency lighting, Thorn has developed three different ways of testing emergency lighting:

- Addressable Test
  All the emergency light fittings are controlled by a central system. This system automatically tests each luminaire and stores the results for analysis. Addressable test systems are the optimum way of ensuring a fully functional emergency lighting scheme, particularly in medium to large applications.
- SelfTest
  All the emergency lights are equipped with a intelligent processor that automatically tests functionality and battery life. Results are clearly displayed on a bi-colour LED indicator. SelfTest is an ideal option for small to medium applications.
- Manual Test
  A competent individual must walk around the building and perform a manual check for each emergency fitting, which must have a dedicated record sheet. This needs to be completed by hand and stored for inspection by the local authorities.

Peace of Mind
All Thorn emergency luminaires are specifically designed to be genuine emergency fittings. This guarantees that they meet both legal standards and our own exacting specifications. Thorn does not offer converted versions of standard fittings for use in emergency lighting schemes.

Performance, Efficiency, Comfort (PEC)
All Thorn products are designed to adhere to three core values: performance, efficiency and comfort. This is the PEC programme, which delivers quality in a lighting installation.



Performance:
Providing the best visual effectiveness, Thorn emergency luminaires provide emergency lighting and signage that clearly comply with the legal requirements laid out in EN1838, the European norm.

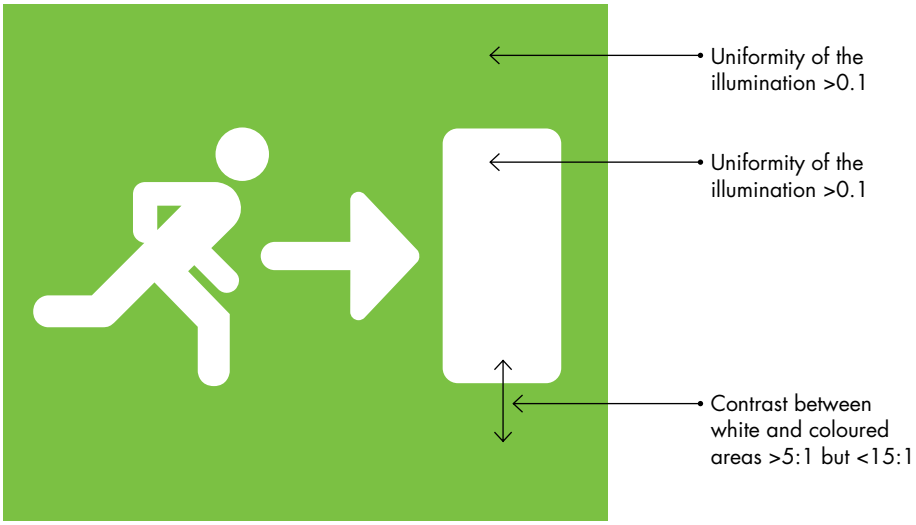
Efficiency:
Minimising the use of energy, CO_2 emissions and waste. Our emergency products are carefully engineered to consume the least possible power and to provide a long-life solution. In addition, Thorn offers Addressable Test and SelfTest fittings that deliver valuable cost savings.

Comfort:
Giving people satisfaction and stimulation. Inclusion of emergency versions of standard luminaires ensures a 'clutter-free' architectural scheme. A stylish range of dedicated emergency fittings includes lighting and exit signage to suit all applications. Addressable Test and SelfTest luminaires automatically test the emergency lighting and identify when maintenance is required.

Emergency lighting legislation lays down specific requirements for the design and performance of exit signage. All Thorn emergency exit signs are designed to comply with these regulations.

Technical Design Requirements

- Mounting Height
  Exit signs should be mounted at a minimum height of 2 metres above the floor.
- Colour Luminance
  Minimum safety colour luminance must be 2cd/m^2



Style of Legend

There are two designs of exit sign that comply with the legislation.

Image 1 is the pictogram from the European Safety Sign Directive. Thorn exit signs are normally supplied with this type of legend

Image 2 conforms to ISO 6309 (EN 5499, part 1).

Please note, although both forms of legend are in use, only one style should be deployed in any one building.

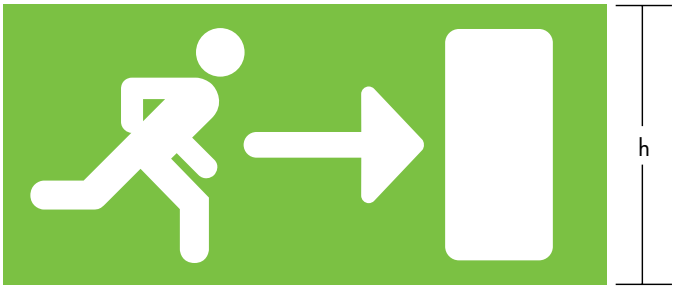


Image 1

Image 2

Viewing Distance

Exit signs must be placed at any change in direction to indicate the route to the final exit door.

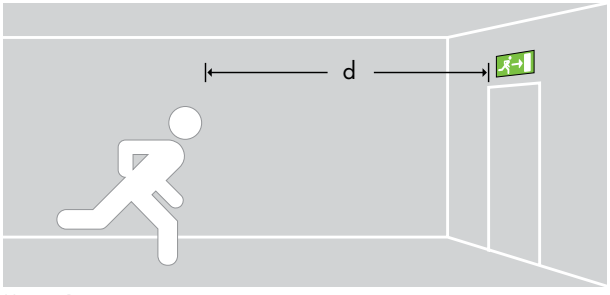
The viewing distance is the distance from which the sign can be seen and understood. The viewing distance of an exit sign is dependent on two factors:

1. Whether the sign is lit internally or externally.
2. The height of the legend (the green exit sign).

Viewing distance is calculated using the following formulae:

Internally lit
Viewing distance (d) =
Height of legend (h) x 200

Externally lit
Viewing distance (d) =
Height of legend (h) x 100

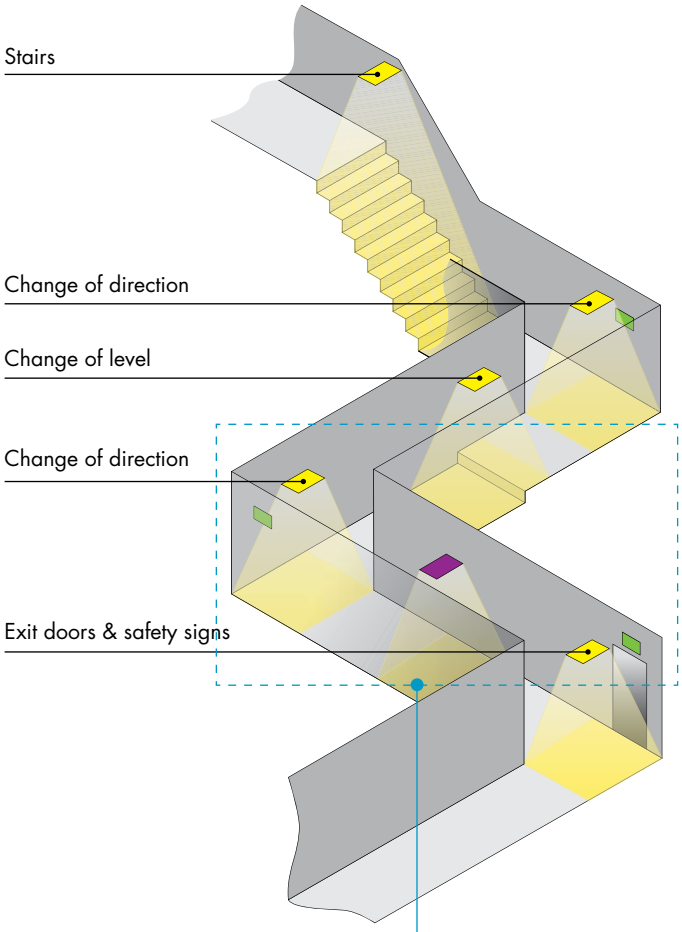


Viewing Distance

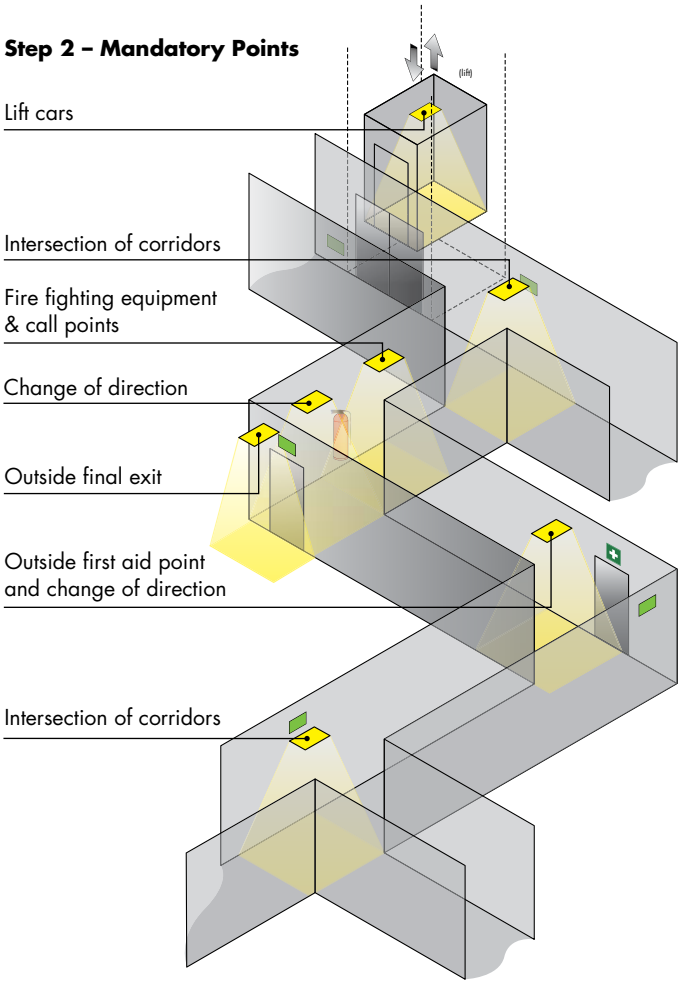
Externally lit signs must be fully lit whenever people are present in the building.

These illustrations show exactly where you must locate emergency lighting and signage.

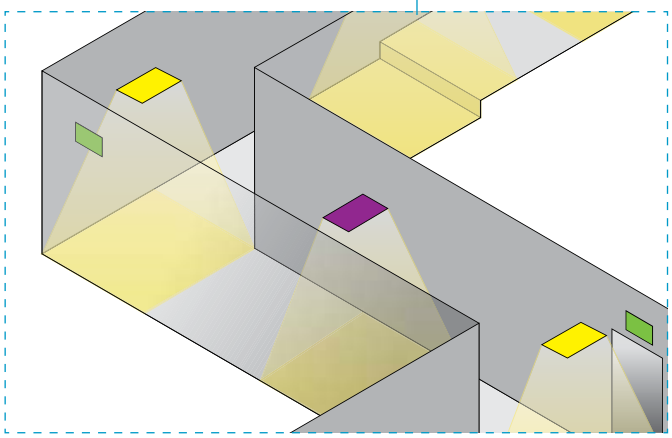
Step 1 – Exit Signage



Step 2 – Mandatory Points



Step 3 – Infill Lighting



Additional luminaire(s) are needed to fulfil emergency lighting level requirements

Key

- Exit sign
- Emergency luminaire
- Infill luminaire

Emergency luminaires have to be carefully positioned to ensure a compliant emergency lighting scheme.

Three steps to an effective emergency lighting scheme:

Step 1 – Exit Signage
Signage must be placed to provide a clear and unambiguously marked route to the final exit.

Step 2 – Mandatory Points
Emergency fittings must be installed at certain mandatory points to provide essential light. As shown in the diagram above, these points include changes of level, intersections of corridors, fire-fighting equipment and first aid posts.

Step 3 – Infill Lighting
In addition to the lighting of mandatory points, infill luminaires may be required to achieve the correct emergency lighting levels.

When designing an emergency lighting scheme, levels of glare must be carefully considered.

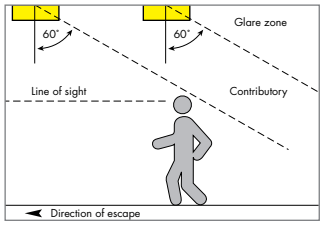
Emergency fittings should be positioned to be free from disability glare. Disability glare is where the brightness of the luminaire dazzles people, preventing obstructions or signs from being properly seen.

The table below shows the permitted glare limits, as set out in the current standard.

Mounting Height h	Escape Route & Open Area Max. Luminous Intensity Imax	High Risk Max. Luminous Intensity Imax
m	cd	cd
h<2.5	500	100
2.5≤h<3.0	900	1800
3.0≤h<3.5	1600	3200
3.5≤h<4.0	2500	5000
4.0≤h<4.5	3500	7000
4.5<h	5000	10000

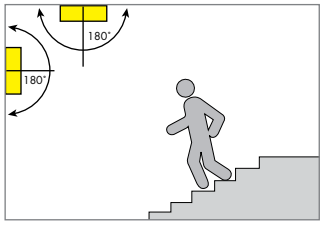
Horizontal Routes

The glare calculation takes into account the number of luminaires that can be seen and the contribution of glare from each of these fittings. For horizontal routes, any glare above 60° is considered to contribute to the disability glare values.



Change of Level

Wherever there are changes in level, glare levels should not be exceeded at all angles.



In the example shown in diagram 1, the Voyager Elite luminaires are mounted transversely (with their longest point facing along the corridor) at a height of 2.4 metres. There are three emergency luminaires in the field of view. Therefore, the level of disability glare is calculated as follows:

3 x 64.2 = 192.6cd

This value is significantly below the 500cd for luminaires mounted at 2.4 metres. See page 11 for further details.

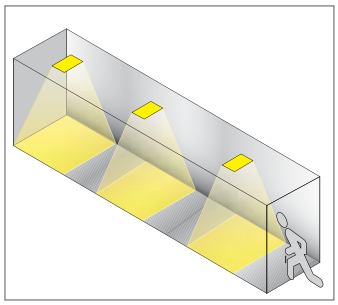
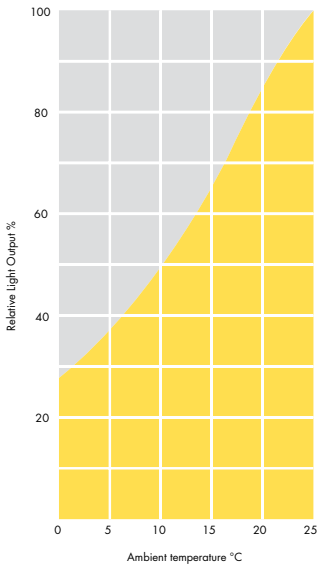


Diagram 1

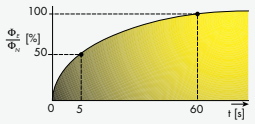
Light Output and Ambient Temperature



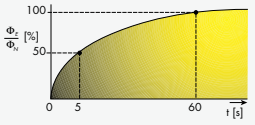
Emergency light output of fluorescent lamp luminaires will vary depending on the ambient temperature.

This part will focus on the practical application of emergency lighting.

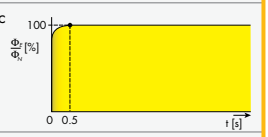
Escape Route

Definition	Clearly defined exit route, including moving walkways, which must always be kept clear
Routes	Considered as a 2m wide strip or a series of 2m strips
Lighting level	Minimum 1 lux on centre line at floor level. Minimum 0.5 lux on 0.5m either side of the centre line (50% of the route width)
Diversity: Φmax : Φmin Ratio of max illuminance to min illuminance	< 40 : 1
Response time Time to reach emergency lighting levels	50% in 5 sec 100% in 60 sec 
Colour rendering (Ra)	>40
Glare: High contrast between luminaire and background leads to glare. Disability glare prevents you seeing properly	See table on page 6

Open Area

Definition	Escape area - Open or re-configurable area, including covered car parks and stepped areas in covered stadia (excluding designated escape routes)
Areas	> 60m²
Lighting level	Minimum 0.5 lux in core area (excludes 0.5m border)
Diversity: Φmax : Φmin Ratio of illuminance to min illuminance	< 40 : 1
Response time Time to reach emergency lighting levels	50% in 5 sec 100% in 60 sec 
Colour rendering (Ra)	>40
Glare: High contrast between luminaire and background leads to glare. Disability glare prevents you seeing properly	See table on page 6

High Risk Task

Definition	Areas where a hazardous activity must be made safe or terminated before evacuation, to prevent injury to passers-by or damage to equipment or the building
Areas	Defined by task
Lighting level	10% of maintained (normal) illuminance on the reference plane or at least 15 lux
Diversity: Φmax : Φmin Ratio of illuminance to min illuminance	< 10 : 1
Response time Time to reach emergency lighting levels	100% in 0.5 sec 
Colour rendering (Ra)	>40
Glare: High contrast between luminaire and background leads to glare. Disability glare prevents you seeing properly	See table on page 6

Emergency lighting is designed to ensure safe evacuation of a building, reduce panic and confusion and safely manage high risk tasks in the event of a mains power failure.

As a result, emergency lighting can be split into three key sections: escape route, open area and high risk task.
As shown in the table, the requirements of the emergency lighting vary according to the specific section.

Fire call points, fire extinguishers and first aid points, not on the escape route must be lit to 5 lux.

This hypothetical application gives examples of areas that require emergency lighting. It also includes a brief list of requirements that different types of emergency lighting must satisfy.

1 Office
Type: Open area

General requirements: computers widely used on modular desking systems require the elimination of screen glare. Direct/indirect luminaires (like Jupiter II or Sienna) brighten the ceiling

Emergency requirements: open area. Exit signs must be visible from all points. Design integration by use of emergency versions of mains fittings.

2 Corridor
Type: Escape route

General requirements: a link between different rooms where good levels of lighting are important, but without sacrificing ambience. Some spotlighting for specific features.

Emergency requirements: clearly defined escape routes. Directional exit signs must be used to clearly indicate escape route. Design integrity maintained by using emergency versions of mains fittings (e.g. Amazon bulkhead or Cruz downlight) for infill lighting.

3 Toilet/washroom area
Type: Open area

General requirements: functional areas that must reflect the design approach of the building as a whole and provide adequate lighting.

Emergency requirements: open area. In toilet/washroom cubicles over 8m^2 two emergency luminaires are required. These can be emergency versions of mains fittings or separate dedicated emergency products (e.g. Thames bulkhead or Voyager Exel emergency luminaire). Toilet/washroom cubicles less than 8m^2 require emergency lighting if there is no 'borrowed' light (e.g. light coming in from a high level window).

4 Plant room
Type: High risk task

General requirements: good light levels, impact resistance and durability are key criteria.

Emergency requirements: high risk task. Area Specific tasks must be completed in the event of mains failure. Special quick response fittings such as Voyager Twin Spot should be used.

5 Show room
Type: Open area

General requirements: use of spotlights highlights exhibition panels and exhibits. Downlights give more general lighting whilst providing dramatic ambience

Emergency requirements: open area. Exit signs must always be visible. Emergency versions of downlights (e.g. Cruz) used to integrate with design and Voyager LED Spot for effect.

6 Conference suite
Type: Open area

General requirements: good dimmable lighting is required, with a mixture of linear fluorescents and downlights. Local spotlighting for lecture area.

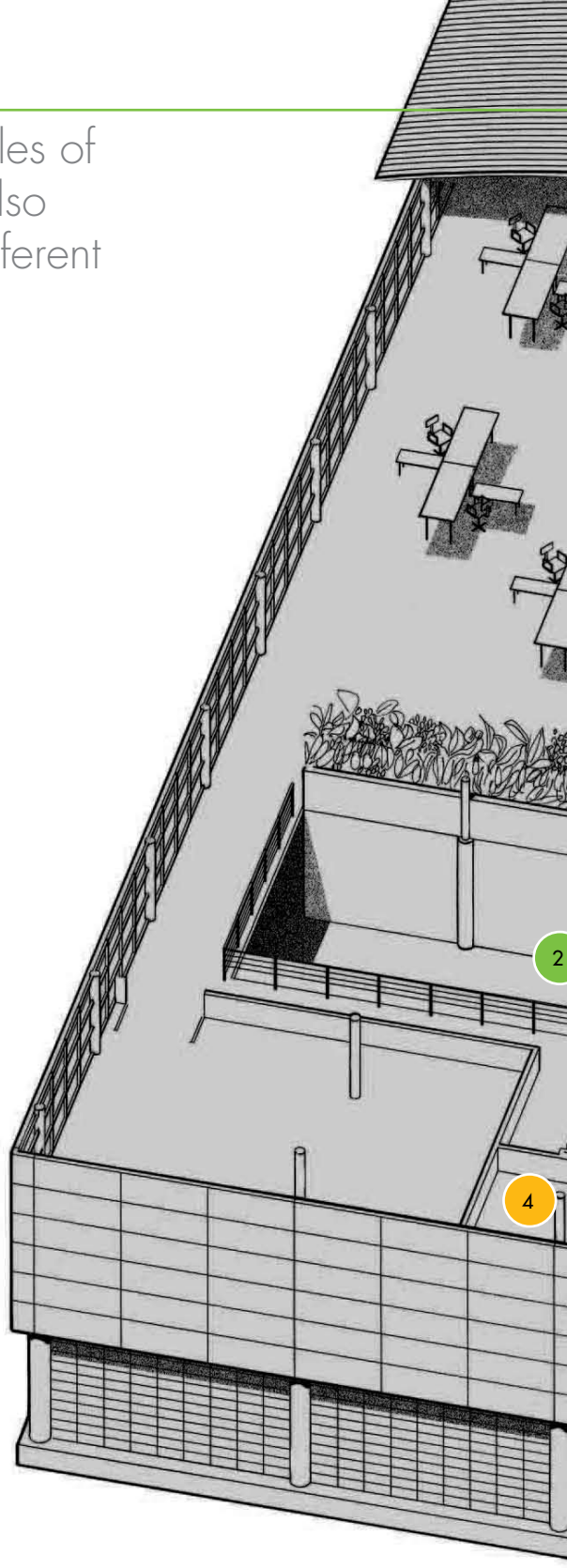
Emergency requirements: open area. Exit signs must always be visible. Emergency versions of linear fluorescent luminaires (e.g. Jupiter II) integrate with mains lighting scheme. Emergency versions of downlights (e.g. Cruz) used over clearly defined escape routes. Auditoria additionally require 0.1 lux along a line 1m above the floor. Escape stairs and routes must be lit to the normal requirements.

7 Reception
Type: Open area

General requirements: an area requiring high visual impact, where use of decorative wall and ceiling mounted products create stylish ambience, whilst downlights and spotlights add focus.

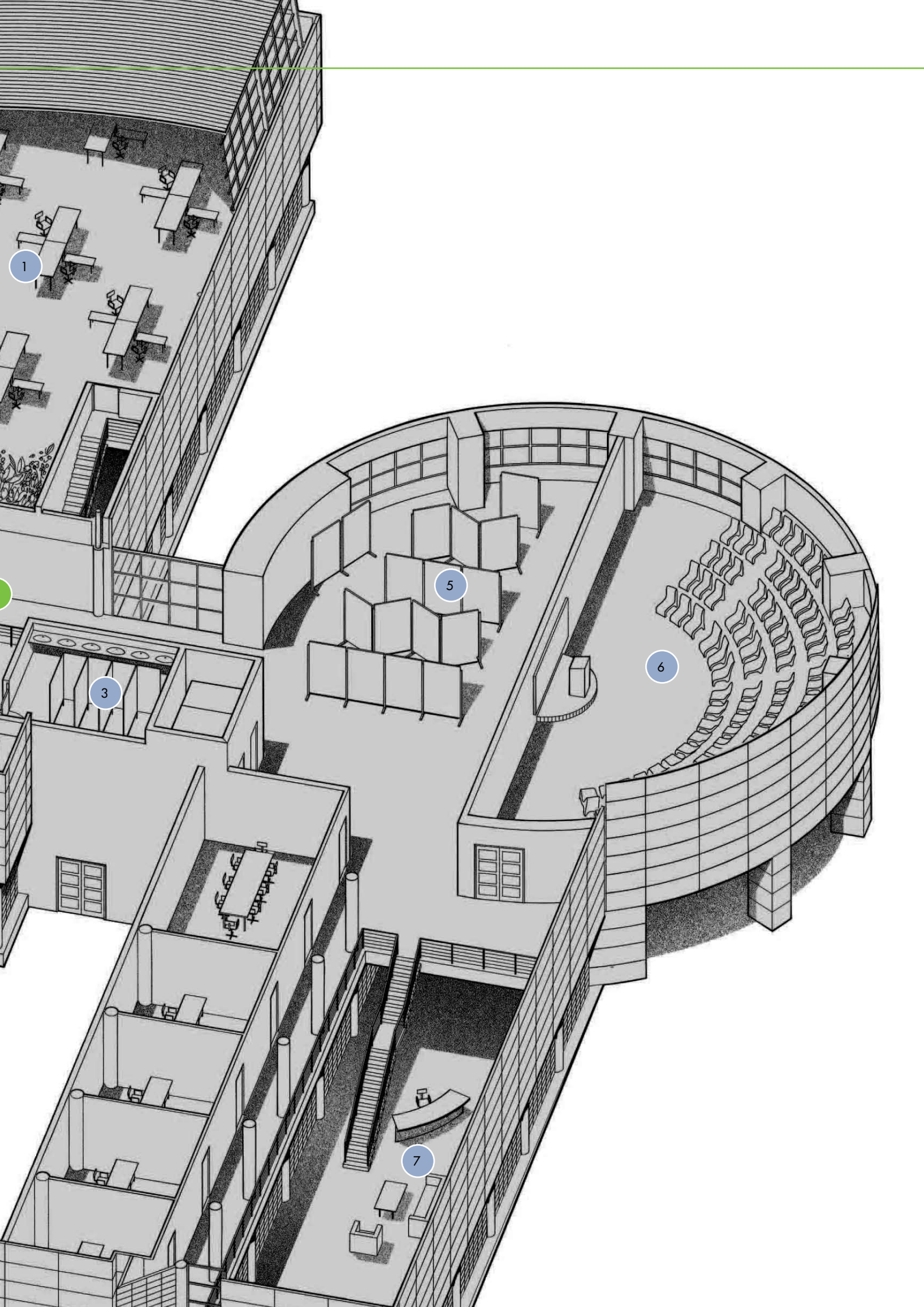
Emergency requirements: open area. In public spaces, exit signs must be lit whenever there are people in the building. Stairs require a minimum of 1 lux on the tread of each stair. Emergency versions of wall and ceiling mounted decorative products (e.g. Glacier II pendant or Cruz downlights) integrate with design and provide aesthetic impact.

Stylish exit signs match the design-led focus for this area (e.g. Voyager Elite).



EN50172 requires a minimum of 2 emergency luminaires to be used in open areas and compartments of an escape route (e.g. part of a corridor between fire doors).

Plant rooms without moving machinery or with low potential risks can be lit as standard open areas. Generator rooms require self-contained emergency luminaires.


1
3
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Product name: Voyager Elite
Product type: Emergency bulkhead

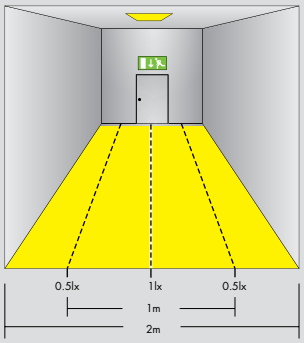
Defined escape route: 2 metres wide

Mounting height: 2.4 metres

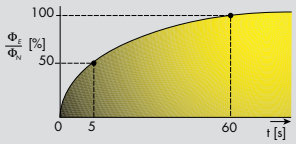
Mounting orientation: Transverse

Lighting requirements:
1 lux along the centre line
0.5 lux for 0.5 metres either side of the centre line (1 metre in total)

Diversity: 0.025



Response time:
50% of emergency lighting output in 5 seconds
100% in 60 seconds



Emergency Lighting Data Table

2m escape route

Centre-line					
Minimum illuminance (lux)	Mounting height (m)	Centre to end		Between centres	
		Maximum spacing (m)	Diversity	Maximum spacing (m)	Diversity
0.2 Trans	2.5	7.55	0.059	19.00	0.030
	3.0	7.90	0.086	20.02	0.043
	3.5	8.05	0.116	21.20	0.059
0.2 Axial	2.5	6.66	0.073	8.80	0.037
	3.0	3.85	0.107	9.50	0.053
	3.5	4.05	0.147	10.10	0.072
1.0 Trans	2.5	3.45	0.298	10.20	0.149
	3.0	3.20	0.429	10.20	0.213
	3.5	2.95	0.587	9.80	0.293
1.0 Axial	2.5	1.95	0.370	5.30	0.189
	3.0	1.90	0.535	5.50	0.264
	3.5	1.70	0.718	5.50	0.364

Glare

Disability glare data

Maximum intensity (cd)	Transverse	Axial
Level route 60-90°	64.2	8.0
Non-level route 0-90°	64.2	27.0

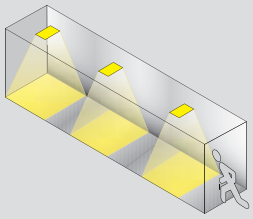


Diagram 1

Transverse and Axial Spacing

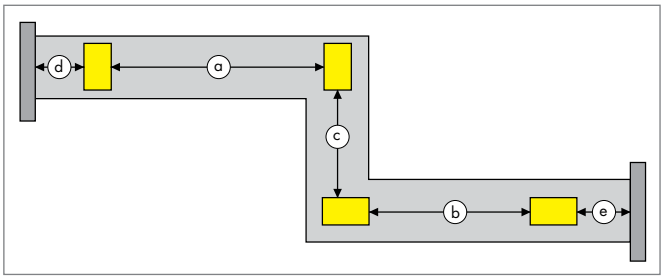


Diagram 2

Spacing to Achieve Specified Lighting Levels

Using the emergency lighting data table, round up to the nearest mounting height. For example, use 2.5 metres for a fitting mounted at 2.4 metres. In this case study, the Voyager Elite emergency bulkheads will provide the correct lighting level when spaced at 10.2 metre intervals.

Diversity

The diversity level of 0.149 is compliant, as it is comfortably above the specified limit of 0.025.

Glare

In this example (Diagram 1), there are three emergency luminaires in the field of view. Therefore, the level of disability glare is calculated as follows:

3 x 64.2 = 192.6cd

This value is significantly below the 500cd (see glare table on page 6) for luminaires mounted at 2.4 metres.

Transverse and Axial Spacing

The spacing of emergency luminaires is also dependent on the way the emergency luminaire is mounted – transverse or axial.

Transverse mounting is when the fitting is installed with the longest point facing along the corridor. Axial mounting requires the longest point to be mounted in line with the corridor.

Using diagram 2 as an example, the spacing should be calculated as follows:

a) Transverse – 10.2 metres
b) Axial – 5.3 metres
c) Transverse to axial – 50% of the transverse (5.1 metres) + 50% of the axial (2.65 metres) = 7.75 metres
d) Transerve to wall – 3.45 metres
e) Axial to wall – 1.95 metres

Calculating Emergency Lighting Schemes using Lighting Design Software

When using lighting design software for escape route, open area or high risk task, certain rules must be observed:

- The room reflectances must be set to zero.
- Set reference plane to floor level.
- Obtain the emergency lighting design lumens (ELDL) from the Thorn Product Explorer (Dialux/Relux Data Plug-In).
- When calculating the average illuminance choose the lower of F5, F60 and Fend. (K)
- The value for the luminous flux is ELDL x K. NB. The first ELDL figure quoted is flux after 3000 hours for a maintained fitting. The next figure in brackets is the initial flux for a non-maintained fitting. Make sure the correct ELDL value is used for the luminous flux calculation.
- When considering the glare, the highest value of K should be used.
- For illuminance, take the ELDL value and multiply it by K. Use this value for the emergency lighting scheme calculations.

Product name: Voyager LED Area
Product type: LED downlight

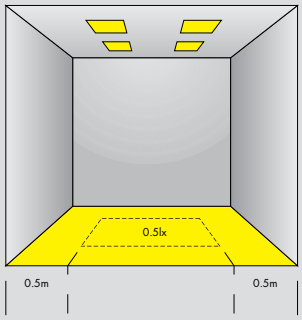
Open area: Areas > 60 m²
Toilets > 8 m²

Mounting height: 2.4 metres

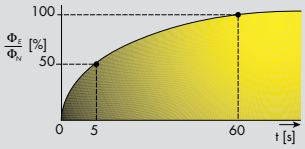
Mounting orientation:
Not relevant for fittings with a symmetrical light distribution

Lighting requirements:
0.5 lux across the floor (excluding a 0.5 metre strip around the perimeter)

Diversity: 0.025



Response time:
50% of emergency lighting output in 5 seconds
100% in 60 seconds



Emergency Lighting Data Table

Open Area

Centre-line					
Minimum illuminance (lux)	Mounting height (m)	Centre to end		Between centres	
		Maximum spacing (m)	Diversity	Maximum spacing (m)	Diversity
0.5 Trans	2.5	3	0.25	10	0.25
	3	3	0.4	10.5	0.4
	4	1	0.65	11	0.65
0.5 Axial	2.5	3	0.25	10	0.25
	3	3	0.4	10.5	0.4
	4	1	0.65	11	0.65

Glare

Disability glare data

Maximum intensity (cd)	Transverse	Axial
Level route 60-90°	48.9	48.9
Non-level route 0-90°	48.9	48.9

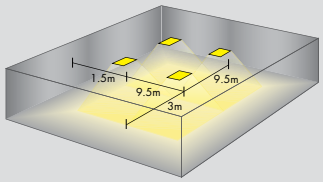


Diagram 1

Spacing to Achieve Specified Lighting Levels

Using the emergency lighting data table, round up to the nearest mounting height. For example, use 2.5 metres for a fitting mounted at 2.4 metres. In this case study, the Voyager LED Area emergency downlight will provide the correct lighting level when spaced at 9.5 metre intervals.

Diversity

The diversity level of 0.4 is compliant, as it is comfortably above the specified limit of 0.025.

Glare

In this example (Diagram 1), there are 4 emergency luminaires in the field of view. Therefore, the level of disability glare is calculated as follows:

4 x 48.9 = 195.6

This value is significantly below the 500cd (see glare table on page 6) for luminaires mounted at 2.4 metres.

Transverse and Axial Spacing

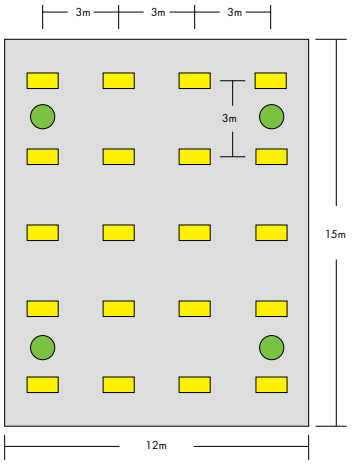
In open area applications, the spacing of emergency luminaires is still dependent on the way the emergency luminaire is mounted – transverse or axial.

Using diagram 2 as an example, the spacing should be calculated as follows:

a) Transverse – 10 metres
b) Axial – 10 metres
c) Transerve to wall – 3 metres
d) Axial to wall – 3 metres

Please note, transverse and axial measurements are the same when the fitting has a symmetrical distribution.

Transverse and Axial Spacing



Key

- Non-emergency luminaires
- Voyager LED Area luminaires

Diagram 2

Product name: MenloSoft SR
Product type: Recessed fluorescent

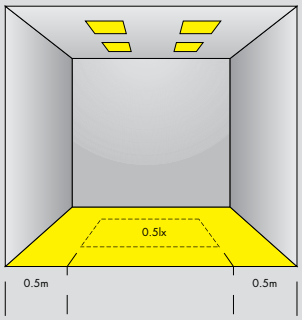
Open area: Areas > 60 m²
Toilets > 8 m²

Mounting height: 2.4 metres

Mounting orientation:
Not relevant for a 600mm by 600mm fitting with an almost symmetrical light distribution. However, all fittings should be mounted in the same orientation in the ceiling grid.

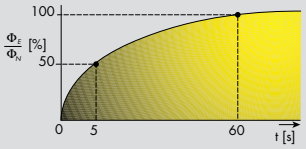
Lighting requirements:
0.5 lux across the floor (excluding a 0.5 metre strip around the perimeter)

Diversity: 0.025



Response time:
50% of emergency lighting output in 5 seconds

100% in 60 seconds



Emergency Lighting Data Table

Open Area

Centre-line						
Minimum illuminance (lux)	Mounting height (m)	Centre to end		Between centres		
		Transverse	Axial	Transverse	Axial	Diversity
0.5	2.5	2.45	2.45	7.20	7.20	0.11
	3.0	2.60	2.60	7.80	7.80	0.158
	3.5	2.70	2.70	8.40	8.40	0.215

Glare

Disability glare data

Maximum intensity (cd)	Transverse	Axial
Level route 60-90°	27.7	21.3
Non-level route 0-90°	73.0	68.6

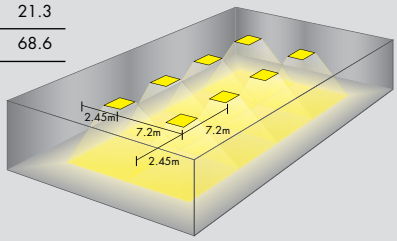


Diagram 1

Transverse and Axial Spacing

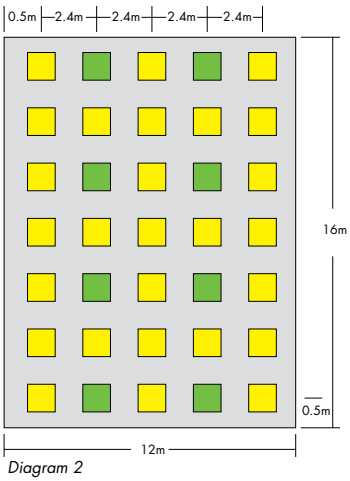


Diagram 2

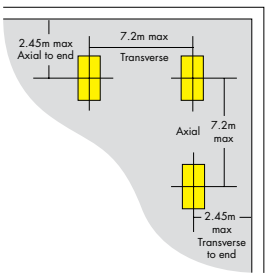


Diagram 3

Key

- Non-emergency luminaires
- Emergency luminaires

Calculating the Number of Required Luminaires

When designing a lighting scheme, the first step is to position the luminaires to achieve the desired lighting level.
Once the standard scheme is defined, certain fittings will need to be emergency versions to ensure the correct lighting levels are achieved in the emergency mode.

In this example (Diagram 2), the luminaires are positioned on a 2.4 metre ceiling grid. This spacing requires 35 luminaires, of which 8 are emergency versions. This will deliver 400 lux in the normal mode and the 0.5 lux required for open spaces in the emergency mode.

Spacing to Achieve Specified Lighting Levels

Using the emergency lighting data table, round up to the nearest mounting height. For example, use 2.5 metres for a fitting mounted at 2.4 metres. In this case study, the emergency variant of the Menlosoft SR will provide the correct lighting level when spaced at 7.2 metres (between centres) and 2.45 metres from the wall (centre to end).

For a typical size room (16 metres by 12 metres), the luminaires would be arranged as shown in Diagram 2.

Diversity

The maximum diversity level of 0.110 is compliant, as it is comfortably above the specified limit of 0.025.

Glare

In this example (Diagram 1), there are a maximum of 8 emergency luminaires in the field of view. Therefore, the level of disability glare is calculated as follows:

8 x 27.7 = 221.6cd

This value is significantly below the 500cd (see glare table on page 6) for luminaires mounted at 2.4 metres.

Transverse and Axial Spacing

In open area applications, the spacing of emergency luminaires is still dependent on the way the emergency luminaire is mounted – transverse or axial.

In this example (Diagram 2), the axial and transverse distributions are symmetrical.

Transverse and axial spacing need to be considered for any fittings that do not have a symmetrical output.

An example of a full emergency data sheet and a section on how to read this information is included at the back of this guide.

Special quick response fittings such as Voyager Twin Spot provide instant light.

Recessed fluorescent cleanroom fitting with special emergency gear for luminaire operation in a high risk task area.

What is a high risk task area?

High risk task areas typically include one or more of the following:

- Any area where there is moving machinery or vehicles. Example: an industrial lathe
- Where flammable or corrosive materials are present. Example: a kitchen or chemical processing plant
- Control rooms for processes that are potentially dangerous. Example: a railway signalling box or power station control centre
- Any activity that needs to be carefully shut down in the event of mains power failure. Example: a hospital operating theatre

What are the regulations governing high risk task areas?

The regulations governing high risk task areas are clearly laid down in the lighting standard EN1838. This states that emergency lighting must meet the following requirements:

- A minimum of 10% of the normal illuminance or 15 lux (which ever is the greater output)
- This output must be fully achieved within 0.5 seconds
- The emergency lighting must function for as long as the hazard exists e.g. until any dangerous process is safely shut down
- The diversity must be < 10:1
- Colour rendering has to be Ra > 40

How do you light a high risk task area?

Designing a scheme for a high risk task area is all about ensuring adequate emergency lighting is provided for the specific high risk activities within an application.

For example, in a workshop application, a piece of heavy industrial machinery such as a milling machine would require high risk task lighting. The rest of the workshop would be treated as an open area.

By strategically placing the emergency near to the hazard, fewer additional emergency luminaires are required.

What kind of emergency fittings should be used?

The need for high output and fast activation makes tungsten halogen luminaires particularly suitable for high risk task areas.

If other lamp types are used in this kind of application, particular care must be taken to ensure that output and activation requirements are fully achieved. This may mean the use of special emergency gear with a quick start capability, so that full emergency output is reached within the stated limit of 0.5 seconds.

In this case, to meet the regulations, luminaires may need to have more than one lamp that operates in the emergency mode. Each lamp may require its own emergency gear to achieve the designed lighting levels. Central battery systems may also help meet the requirements in this type of application.

Product name: Voyager Twin Spot
Product type: Tungsten halogen dual spotlight

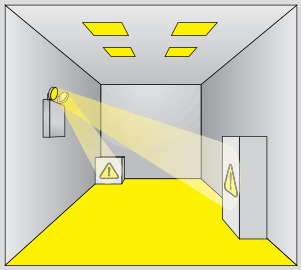
High risk task area:
Areas of high potential risk, control rooms for dangerous plant and production centres or dangerous machinery and processes that need to be shut down safely.

Mounting height:
Dependent on application. Typically above 4 metres. NB. Beware of glare at low mounting heights.

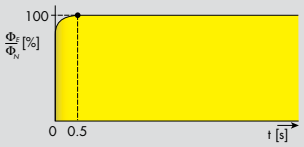
Mounting orientation:
Generally wall mounted.

Lighting requirements:
A minimum of 10% of the normal illuminance or 15 lux (which ever is greater)

Diversity: < 10:1



Response time:
100% of emergency lighting output in 0.5 seconds



Spacing to Achieve Specified Lighting Levels

Lighting a high risk task area requires specific lighting on the particular function or process that carries the potential danger. In some cases, a single room application may contain more than one high risk task.

The dual output beam of the Voyager Twin Spot is particularly suited to focusing on a high risk task. Each individual beam can be set at different angles to ensure that one Twin Spot fitting can light two areas, as shown in the diagram.

High risk task lighting requires the use of lighting design software such as Relux, to ensure key details such as beam angles and lighting levels are correctly defined. Spacing tables should only be used as an initial guide for the required number of luminaires.

Please note that this type of fitting can also be used to provide escape route or open area lighting in large open space applications such as atria or warehouses.

Glare

In this example, with a mounting height of 4 metres, the disability glare limit would be 7000cd, (see glare table on page 6).

Applications: Case Study Four – High Risk Task Area

Product name: Invincible II
Product type: Recessed fluorescent cleanroom fitting**

**containing special high risk task area emergency gear

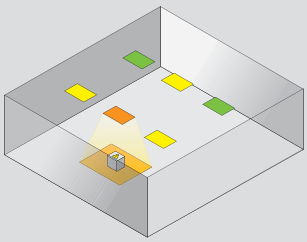
High risk task area:
Areas of high potential risk, control rooms for dangerous plant and production centres or dangerous machinery and processes that need to be shut down safely.

Mounting height:
Dependent on application.
Typically in a 2.4 metre ceiling.

Mounting orientation:
Can be mounted in a range of ceiling grids.

Lighting requirements:
A minimum of 10% of the normal illuminance or 15 lux (which ever is greater)

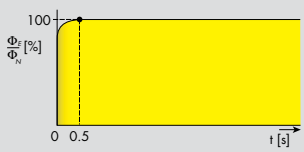
Diversity: < 10:1



Key

- Non-emergency luminaires
- Emergency luminaires
- High risk task emergency luminaires

Response time:
100% of emergency lighting output in 0.5 seconds



Lighting a High Risk Task Area Using Fluorescent Fittings

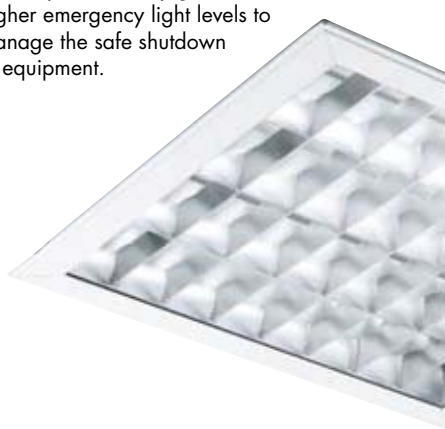
High risk task areas require fittings that have an immediate changeover to emergency function. This means that the gear must switch into emergency mode and provide 100 percent emergency output in 0.5 seconds.

These stringent requirements mean that tungsten halogen solutions are often used in these applications. However, Thorn has developed special emergency modules that enable fittings with fluorescent lamps to meet these regulations.

In a maintained fitting, when the lamp is already lit, this module will enable the lamp to restrike almost instantaneously.

The lamp is lit again in less than 0.25 seconds, compared with a typical 2 second restrike for a standard emergency luminaire.

This solution is particularly useful in applications such as cleanrooms and kitchens, which require fewer surfaces where dust or particles may gather and higher emergency light levels to manage the safe shutdown of equipment.



All emergency lighting schemes have to comply with European legislation and regulations.

Emergency lighting design schemes are used to ensure that the installation will meet required lighting levels and protect the occupants with escape route, open area and high risk task lighting.

Once the scheme is installed and commissioned, it is essential that the luminaires are properly maintained and ready to perform in the event of an emergency. To make sure installed emergency products are always fit for purpose, regular testing has to be conducted by the building operator.

Frequency	Nature of Test	Purpose
Daily	Check all LED charging indicators are in operation	Ensure the batteries are being charged
Monthly	Conduct a functional test for all emergency luminaires	Check that the luminaire will operate in the emergency mode
Annually	Perform a full 3 hour duration test for all emergency luminaires	Confirm that the battery capacity will operate the product for the required 3 hour time period

Testing Emergency Lighting Products

Emergency lighting products have to be tested regularly to meet the requirements of European law. As shown above, the standard EN50172 stipulates the precise nature and frequency of the testing.

A full record sheet needs to be maintained for each emergency fitting. These sheets have to be available for inspection by the authorities at any time. Failure to provide full test records can result in legal action and closure of the building. In the event of an emergency, if the emergency lighting is defective, the insurance policy for the building may be invalidated and the building operator could face a heavy fine or imprisonment.

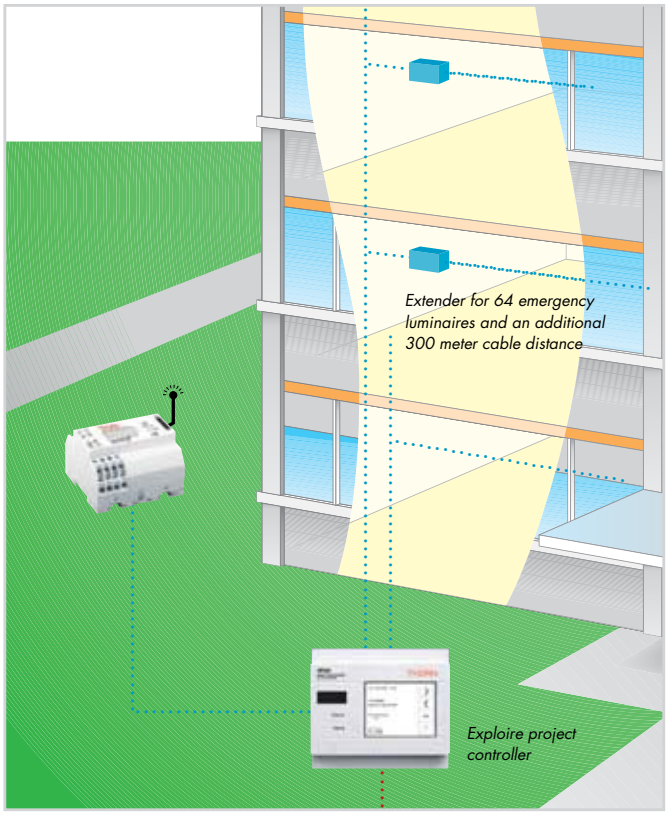
Recent changes to the laws governing emergency lighting have shifted the responsibility for the testing to the building operator. This testing can be tedious, costly and time consuming.

Making Life Easy

To help building operators maintain a fully functional emergency lighting scheme that meets the full raft of legal requirements, Thorn offers three testing solutions:

- Central addressable testing
- Automatic self testing
- Basic manual testing

Typical Explorer Project installation



GSM module will send a text message alert when maintenance is required.

Central Addressable Testing

Every emergency luminaire is connected to an intelligent local controller that automatically conducts all the necessary tests and stores the full results in one central location.

Explorer Project

Explorer Project is a central addressable testing system that provides fully automatic monitoring, testing and fault logging for up to 256 emergency fittings. This system delivers a range of benefits:

- Ultimate convenience for emergency lighting testing.
- All results automatically stored for two years in one location. No need for paperwork.
- Fault logging function identifies each luminaire, the location and the precise nature of the fault.
- Coverage of emergency products that are up to 900 metres from local controller in any direction
- All tests conducted at a convenient time, depending on the usage of the application
- Group testing staggers the testing to minimise the risk of depleted batteries.
- Simple to install and commission.
- Intelligent luminaires linked to the local controller using standard 1.5mm 2 core mains cable.

Applications

This system is particularly suitable for small to medium projects looking for an easy and convenient way of maintaining their emergency lighting scheme for stringent inspection. Key examples include schools, colleges, small offices, surgeries, libraries and public buildings.

Explorer Vision
For larger applications with more than 256 emergency fittings, Explorer Vision allows the building operator to monitor and manage the emergency lighting scheme from a standard computer. Building on the foundations of Explorer Project, Explorer Vision enables a standard computer to communicate with the local controller using the installed computer network.

Explorer Vision is ideal for schemes with up to 5000 emergency luminaires. In applications such as university accommodation blocks, hotels, large offices, hospitals and air ports, Explorer Vision will deliver significant time and cost savings in terms of maintenance and inspection.

Easy-to-use Explorer Vision screen shows the status of each emergency luminaire.

Automatic Self Testing
Each self test emergency luminaire contains an intelligent diagnostic processor that automatically performs the testing and uses the integrated bi-colour LED indicator to show the test results.

Explorer SelfTest fittings provide simple and reliable standalone automatic testing solutions. The building operative only needs to walk around the building once a month and check the status of the LED indicators. The overall result must be recorded in a central log book, with details of any failures.

9 February 2008

ALL LEDs showing green. System clear of all faults.

10 March 2008

One LED showing steady red. Luminaire opposite the lift on second floor requires lamp replacement. ALL other LEDs showing green.

Explorer SelfTest fittings offer a variety of benefits:

- Easy to install, with no additional cabling and automatic self-commissioning
- The building owner only needs to walk round the building once per month and record the result
- Faster than average recharge time for emergency batteries (around 10 - 15 hours, compared to 24 hours for Manual Test fittings)
- 3 hours operation, to facilitate re-entry following an evacuation
- Bi-colour LED (red and green) to provide clear status indication
- Boost starting technology gives higher lumen output during most critical phase to ensure greater visibility of potential danger
- Cathode heating during emergency operation prolongs emergency lamp life
- Intelligent processor learns to test while the building is unoccupied, reducing potential risk

Test	LED Indicator	Duration	Frequency	EN requirement
Function Test (Energise luminaire from battery briefly to simulate mains failure)	Green Rapid Flash	30 seconds	Weekly	Monthly
Duration Test (Energise luminaire for full rated duration)	Green Slow Flash	1 or 3 hours	Annually	Annually

Component	LED Indicator	Status
Battery	Green Steady	Healthy
	Red Slow Flash	Low
	Red Rapid	Not charging
Lamp	Green Steady	Healthy
	Red Steady	Failure

Applications
Explorer SelfTest is an ideal testing solution for small applications or building refurbishments. Key examples include small shops, offices and public buildings.

Basic Manual Testing
This kind of emergency luminaire relies on intensive human intervention to comply with the stringent testing regulations.

Every month a competent individual must walk around the site and manually switch the fittings into the emergency test mode. This will perform a functional test, after which an individual record sheet must be completed and safely stored. The same process must be carried out for the 3 hour duration test once every year.

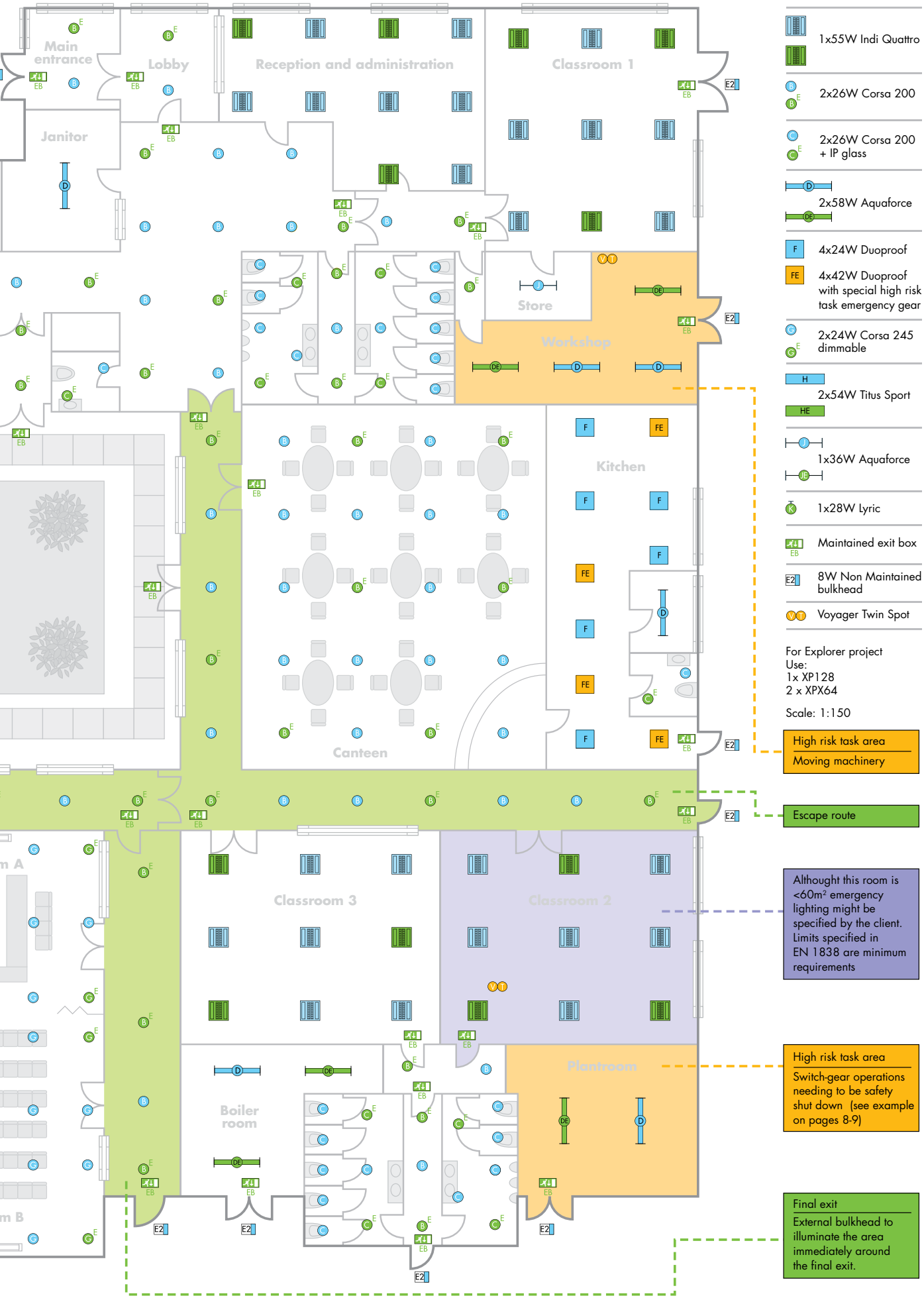
In this case, the LED indicator only shows whether the battery is being charged. Any further fault requires manual examination of the fitting. Combined with the fact that a competent individual has to walk around the site every month, basic manual testing luminaires incur high whole life costs due to expensive labour charges for testing and maintenance.

Applications
Basic manual test is suitable for budget-driven installations where the whole life costs are not considered.

Example of Building Floorplan

No emergency lighting is included in the office areas as they each <60m². However, emergency lighting may still be specified by the client.

Sports areas have specific emergency lighting requirements. These depend on the main activity taking place in the application. Please refer to EN12193 for more information.


Main entrance
Lobby
Reception and administration
Classroom 1
Janitor
Store
Workshop
Kitchen
Canteen
Classroom 3
Classroom 2
Plantroom
Boiler room
1x55W Indi Quattro
2x26W Corsa 200
2x26W Corsa 200 + IP glass
2x58W Aquaforce
4x24W Duoproof
4x42W Duoproof with special high risk task emergency gear
2x24W Corsa 245 dimmable
2x54W Titus Sport
1x36W Aquaforce
1x28W Lyric
Maintained exit box
8W Non Maintained bulkhead
Voyager Twin Spot
For Explorer project
Use:
1x XP128
2 x XPX64
Scale: 1:150
High risk task area
Moving machinery
Escape route
Althought this room is <60m² emergency lighting might be specified by the client. Limits specified in EN 1838 are minimum requirements
High risk task area
Switch-gear operations needing to be safety shut down (see example on pages 8-9)
Final exit
External bulkhead to illuminate the area immediately around the final exit.

Authentic Emergency Luminaires

Integrated Emergency Luminaires: Authentic Products vs Third Party Conversions
There are two main ways of producing integrated emergency luminaires:

- **Specific emergency versions of standard fittings**
  This type of emergency fitting is produced alongside the standard versions of the same fitting, using the same production methods.
- **Converted standard luminaires**
  These products are finished versions of standard luminaires that are then fitted with an emergency kit at a later date.

Genuine Thorn Emergency Products
With over forty years experience in emergency lighting manufacturing, Thorn only offer products that are designed, manufactured and tested to meet the latest European legislation, including:

- EN 60598-1 1998
- EN 60598-2-22 1998
- BS 5266-1 and 7: 1999
- BS 5499-1 and 4: 2000
- CE mark

Thorn only produce specifically designed emergency luminaires to comply with these increasingly stringent requirements. Thorn does not convert standard products.

High quality components, such as diffusers and batteries, are always used by Thorn to ensure optimum performance in all situations and full compliance with the full range of standards and regulations.

Thorn emergency fittings are tested in our BSI-registered photometric laboratory, to ensure correct light output levels can be achieved. These figures can then be used to calculate the best possible emergency lighting design scheme.

Regulations on Electro-magnetic Compatibility (EMC) state that luminaires should not emit or be susceptible to electro-magnetic radiation above certain designated levels. Recent revisions to these standards require luminaires to still meet these levels when operating in the emergency mode. All Thorn emergency fittings comply with these requirements.

The Dangers of Emergency Conversions by a Third Party
Standard fittings that are converted into emergency versions by a third party are subject to a number of potential risks. This may result in failure to comply with legal standards and is likely to negatively impact on the safety, performance and maintenance of the product.

A third party carrying out any modifications immediately takes full responsibility for the product.

A number of factors should be taken into account when considering a standard fitting converted by a third party:

⚠ EMC Conformity
Many third party converters cannot afford to conduct the exacting series of tests required to measure the electro-magnetic performance. This means many fittings produced in this way do not conform to the latest regulations and could ultimately lead to criminal prosecution.

⚠ Component Quality
The use of low-cost or poor quality components will lead to early product mortality and failure to perform fully in an emergency situation. Potential issues include reduced battery life, over-heating, lamp and circuit issues and low light output.

⚠ Photometric Performance
Accurate photometric data is required to ensure a lighting design scheme delivers the specified output needed to protect the safety of people within the premises. A luminaire converted by a third party may have lower output due to the use of poor quality batteries and other components. In this case, an installation will not meet the prescribed lighting levels and the actual performance will not be sufficient to protect the people in the event of an emergency.

⚠ CE Marking
The CE mark is a mandatory requirement for all luminaires on sale in Europe. This marking proves that the product conforms to all relevant safety standards. Conformity requires extensive testing at normal and abnormal conditions and is the responsibility of the last party to modify the product.

⚠ Warranty
Any Thorn lighting product that has been tampered with by a third party immediately loses the original manufacturer warranty. Legally binding warranties, including certificates such as the CE marking, become the responsibility of the third party, who are then exposed to product liability claims.

Any failure of the product during an emergency situation, leading to loss of life, personal injury or damage to property, will expose these parties to criminal prosecution and significant claims for damages through the civil courts. Insurance policies held by the third parties frequently stop short of covering them if this situation arises.

⚠ Trade Mark Infringement
Any product modified by a third party cannot be passed off as an authentic Thorn lighting emergency product. It is illegal to pass off a converted product as a genuine Thorn fitting. Such unlawful practice will exposes the perpetrator and all participants in the supply chain to civil litigation.

For complete peace of mind, always look out for the Thorn authentic emergency product logo. This tamper-proof label proves the integrity of the fitting and clearly indicates quality, performance and conformity.

Planning Sequence

Tick when completed ✓

01 Check for any special emergency lighting requirements e.g. licenced premises, cinema. ☐

02 Mark exits, final exits, escape routes and safe areas. *For reference see pages 4, 5, 7, 18 & 19* ☐

03 Identify open areas and any special locations e.g. stairs, toilets with no windows, toilets over 8m² and toilets for the disabled (minimum 2 luminaires). *For reference see pages 7, 12, 13, 18 &19* ☐

04 Mark hazardous task areas (e.g. plant rooms, kitchens). *For reference see pages 7, 14,15, 18 & 19* ☐

05 Mark the location of fire equipment, alarm points, first aid points and assembly points. *For reference see pages 5,18 &19* ☐

06 Note illuminance and other arrangements e.g. 0.5 lux open area, 1 lux escape route, 5 lux for emergency items not on escape route (e.g. fire extinguisher, fire call point, first aid room). *For reference see page 7* ☐

07 Select signs and emergency luminaires and position at essential locations. *For reference see page 5* ☐

08 Infill additional luminaires to ensure correct emergency lighting levels are achieved. *For reference see page 5, 11* ☐

09 Check diversity and glare. *For reference see page 6* ☐

10 Prepare installation instructions and commissioning procedure ☐

11 Prepare Operating & Maintenance Manuals and Log Book ☐

12 Prepare and sign Declaration of Conformity – Design. ☐

Please photocopy this sheet before completing, so that it may be used again for future designs.

THORN

Lighting people and places

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