Emergency lighting, personal safety

An emergency lighting system is designed to create personal safety and allow the safe evacuation of the building. An emergency lighting system must work faultlessly in all situations which is why high demands are made on reliability. The system is a safety element and must be well designed and planned. The design of emergency lighting systems are specified in the standards BS 5266 Parts 1 & 7 and EN 1838. Demands are made in the standards for different environments and application areas. Examples of different environments where demands vary are: escape routes, anti-panic lighting and lighting of high risk areas.

The emergency lighting system usually consists of a combination of safety signs and general luminaires equipped with an emergency lighting function. An emergency lighting system can be either centralised or decentralised, i.e. with a central power supply or with an integrated emergency lighting solution direct in the luminaire.

Fagerhult has produced an extensive range of products that correspond to all demands.

Lighting of escape routes

“The objective of escape route lighting is to enable the safe exit from a location for occupants by providing appropriate visual conditions and direction finding on escape routes and in special locations, and to ensure that fire fighting and safety equipment can be readily located and used.”

The above sentence means that extra emergency lighting in addition to that lighting the route, is demanded when there are for example, split level floors, corridor crossings, stairs and rescue equipment such as fire extinguishers.

Escape routes 2 m wide require a horizontal illuminance of at least 1 lux along the centre line. The uniformity should be at least 40:1 and glare should, at a normal ceiling height of 2.5 m, be limited to 500 cd/m2 between the angles 60-90 degrees from the vertical line.

The shortest duration for emergency lighting is 1 hour. Safety signs to indicate the right escape route are usually included in evacuation lighting. These are dealt with in a separate section.

With today’s modern light sources such as the T5 and compact fluorescent lamps, significantly higher demands are placed on the technology than with older light sources. For this reason Fagerhult has chosen to work with the major manufacturers of emergency lighting components in Europe. The range includes products with different functions and performance. An example of added functionality is the emergency lighting system with self-test.

Fagerhult’s long-term environment strategy means that environmentally hazardous battery types such as NiCd have been replaced by less hazardous types, for example, NiMh, when technology permits.

BS 5266 Parts 1 & 7 and EN 1838 Lighting - Emergency lighting, describes the demands made on emergency lighting in different areas. Primarily three different areas are included:
- Lighting of escape routes
- Lighting of open areas (anti-panic)
- Lighting of high risk areas
Lighting of high risk areas
“The objective of high risk task area lighting is to contribute to the safety of people involved in a potentially dangerous process or situation and to enable proper shut down procedures to be carried out for the safety of other occupants in the location.”

The illuminance on the reference plane should, during emergency operations, be at least 10% of that usually demanded for the implementation of the tasks, but never lower than 15 lux. Accordingly, this means that if 500 lx is needed for normal operations the lowest requirement for emergency light operations is 50 lx.

In this area, glare should be limited to 1000 cd/m² between the angles 60-90 degrees from the vertical line. This value applies to an installation height of 2.5 m. With greater installation heights a higher luminance is permitted, e.g. 1800 cd/m² at 3 m.

Lighting of open areas (anti-panic)
“The objective of open area (anti-panic) lighting is to reduce the likelihood of panic and to enable safe movement of occupants towards escape routes by providing appropriate visual conditions and direction finding.”

This means a horizontal illuminance of at least 0.5 lux at floor level with a uniformity of at least 40:1. The glare for this area should be limited to 500 cd/m² between the angles 60-90 degrees from the vertical line if the installation height of the luminaires is 2.5 m.

Safety signs/Exit signs
Special regulations and provisions apply for safety signs. In the product standard EN60598-2-22 the electrical safety demands are specified. The design of the actual symbol is specified in ISO3864/ISO7010.

General
It is extremely important that there is clear information showing where occupants should go in the event of a power failure or other reason that can create a dangerous situation. Therefore clear and easy to understand safety signs, should be placed in strategic positions.

Use
There are primarily two different types of safety signs, internally lit or externally illuminated. As an internally lit sign is considered to be easy to discern, the maximum reading distance is twice the distance of an externally illuminated sign of the same size.
Emergency lighting system

Different designs

Products for decentralised emergency lighting systems

Fagerhult can supply emergency lighting luminaires in different designs:

2. Version with integrated self-test (not for connection to control and monitoring systems) that indicates faults both with audio and visual signals.

General

Luminaire models with an integrated emergency lighting function are available for most of our HF-luminaires. As some emergency lighting components, for example the battery, are sensitive to heat the physical location of the components varies from luminaire to luminaire. Some luminaires require the battery or the battery and the emergency lighting electronics to be moved outside of the luminaire and to be placed in a separate enclosure (battery and emergency lighting enclosure). For functional reasons the emergency lighting enclosure must be placed within 0.5 m of the luminaire. Alternatively, the battery enclosure can be placed up to 1 m from the luminaire. Distances greater than 1 m are not possible due to the demands in the relevant product standard (EN60598-2-22).

Connection to the mains

Decentralised emergency lighting luminaires should normally be connected to the mains using a 4-core cable (protective earth, neutral, unswitched live and switched live). This connection means the luminaire can be switched on/off as normal and that the emergency lighting function automatically comes in to force in the event of a power failure. Respective unswitched lives should come from the same fuse box. If an emergency lighting luminaire is only required to function during emergency operations or if the luminaire should be lit constantly, a 3-conductor connection is sufficient.

Basic version

Luminaires equipped with the basic emergency conversion have either all the necessary components fitted integrally, or are prepared to accept an external remote enclosure containing the necessary components. (Emergency lighting electronics, batteries and indicating diode.) The diode indicates that the battery is connected and that it is charging. In the event of a power failure the emergency lighting automatically powers up.

Version with integrated self-test, Autotest.

Besides the component parts in the basic version the emergency lighting luminaire is equipped with an integrated self-test. The self-test, which we call Autotest, is fully self-contained. No programming is necessary. Neither is a connection to an external PC or other supervisory unit. Autotest tests the luminaire regularly via an in-built “schedule” housed in the emergency lighting electronics. As it is preferable for the testing of emergency lighting operations to be performed when no one is in the building, Autotest is fitted with integrated “intelligence” that “learns” the luminaire’s usage pattern.

The self-test works as follows:

The “clock” built into the emergency lighting electronics starts during installation. Over the course of the first 37 days the electronics “learn” when the luminaire is normally switched on and off. After this period Autotest has registered an appropriate time for the necessary tests. The following are checked during each test:

- That the luminaire is connected to the mains
- That the battery is connected
- That battery charging works
- That the light source for emergency operation is intact and works
- That the complete emergency lighting circuit is functioning

How often is the test made?

- Each month a test is carried out with the emergency lighting operating for 5 minutes.
- Every 6 months a test is carried out with the emergency lighting operating for 1 hour.

• Annually a test is carried out with emergency lighting operating for 3 hours.

Resetting after a service

When faults have been indicated and have been rectified the self-test system must be reset. This is done via an on/off operation of the switched live. Switch on the switched live => Switch off as soon as the light source ignites => switch the switched live on again. The system has now been reset. A check is made automatically during resetting, to ensure that the emergency lighting system is functioning.

History

As the tests are normally carried out when no one is present the emergency lighting electronics are equipped with a function that indicates how many times testing has been carried out. This is indicated by the diode in the luminaire. 30 seconds after the luminaire is switched on in normal mode the diode will flash the number of times corresponding to the next test number. Accordingly, flashing 7 times indicates that the next test will be the seventh.

eMLON, monitoring via LonWorks

Most emergency luminaires equipped with integrated self-test, Autotest, can also be equipped with a node for LonWorks communications. The status of the emergency luminaire can be read via the node and testing can be initialised. Testing does not need to be pre-programmed, as this is handled by the self-test unit’s calendar function. More information about the eMLON system is available from our website, where you can find a program description as well as resource files available for downloading.
Fagerhult has developed a new technology for emergency lighting where the light source in emergency mode consists of a high intensity white light emitting diode. This completely changes the prerequisites for designing an emergency light installation compared with traditional techniques.

Emergency lighting is the lighting that is connected in the event of a power failure. A room can be lit sufficiently to help you find an exit or to prevent panic arising by using luminaires with an integrated emergency lighting unit or a central emergency lighting installation.

Emergency lighting is usually used in evacuation routes, but also in environments where many people gather at any one time. For example, in libraries, stores, hypermarkets and office landscapes.
emLED
New technology within emergency lighting

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Emergency lighting is usually used in evacuation routes, but also in environments where many people gather at any one time. For example, in libraries, stores, hypermarkets and office landscapes.
Regard for the environment and battery life
In emLED-s (with integrated battery) we have chosen to use a NiMH battery, this battery type is significantly more environmentally friendly than the more common NiCd type. In addition, NiCd batteries are subject to an environmental tax and within a few years will probably be banned.

Batteries in emergency lighting need to be replaced regularly. How often this needs to done depends on how battery charging is designed, the temperature of the battery and how the system is maintained. When the NiMH-battery in emLED is fully charged, the charger switches when necessary to maintenance charging mode to ensure the battery always has enough capacity. The temperature of the battery is also very low (35° C), which guarantees a very good life.

Maintenance
emLED-s and emLED-sc have been designed so that essential maintenance can be carried out easily. The battery and electronic unit are housed in a separate section, which can be simply snapped open and removed from the housing without the need of disconnecting the supply voltage. Live parts are touch protected even in the open position. The defective part can be replaced by a new insert and trouble shooting can then be performed in your own time. Accordingly, an emLED-installation can be maintained during normal business hours as other units can be operational. The premises do not need to be evacuated when performing maintenance, which is the case with conventional installations. Personal safety is high even during maintenance.

Light technology
In the event of a power failure the emLED is activated and the LED is powered by the integrated battery or via the central emergency lighting system. The reflector around the LED is especially developed to provide wide and balanced light distribution with a minimum of glare. The good light distribution also results in a significant improvement in the uniformity of the floor lighting level when compared to that of conventional systems. EN 1838 stipulates an uniformity at the lowest of 1:40. An emLED-system presents an uniformity of 1:3 or better. This is important when taking the eye’s ability to adapt to prevailing light conditions into consideration.

Emergency lighting with a few, very strong lighting points creates problems in a crisis situation – the eye does not adapt to the different lighting levels quickly, which can make it difficult to find the exits or bring about risks of being injured by “hidden” objects.

Simplified light planning
Emergency lighting must be planned so that there is an adequate level of lighting when in emergency mode. The emLED facilitates your light planning because you only need a light file. This means you do not need to look for information on how the different traditional light sources work in emergency mode.

The table to the left should be used as a guide to how many emLEDs are required and the distances at which they should be placed in order to obtain an adequate level of lighting. All the examples were calculated with the reflection set to 0% of the calculation surfaces.
emLED – heightened personal safety

The emLED concept is based on the use of a highly intensive white light emitting diode (LED). Personal safety is appreciably increased through using a separate light source for the emergency lighting. A traditional solution, where the same light source is used in both standard and emergency modes, can suddenly stop working in a crisis situation because the light source has burnt out.

This risk is virtually eliminated by using a separate light source with an extremely long life. The light emitting diode with a life span of 50,000 hours, in principle never wears out as it is only used for emergency lighting.

emLED - new luminaire solutions

Apart from emLED in standalone designs, emLED components are also available for integration in luminaires. The components require very little space, which means that many luminaires that could not previously be equipped with an emergency lighting function can now be offered in this design.

Even luminaires where the light source prevents an emergency lighting function, for example, metal halogen, or where the light from the outset has the “wrong” direction, for example, uplight luminaires, can now be offered with an emergency light function.

The compact design means that emLED does not “encroach” on the original luminaire design. Naturally emLED is also suitable for use in products that are available with conventional emergency lighting technology, for example, T5-luminaires.

emLED integrated in luminaires

We can supply numerous luminaires with emLED as standard, for other requirements, please contact our customer service. The emLED system is available integrated in most of Fagerhult’s luminaires. Integration kits for emLED are not sold separately.

Self-test

emLED-s and emLED for housing in luminaires both feature an integrated self-test. The self-test checks that the white LED is fully functional after connection and every other hour as well as continuously testing the charging function and the battery capacity. Any faults can be seen on the green status diode.

- Diode not lit = Charging fault or defective battery.
- Flashing diode = white LED faulty.

They are also equipped with a 2-pole output designed for connection to an external monitoring system. The output, which under normal operating conditions is made (NC), opens should a fault be discovered during the self-test. The output, which is controlled via an optoswitch, can be loaded with max 24VDC/50mA.

Wiring diagram - overview

<table>
<thead>
<tr>
<th>24 VDC (min 30mA)</th>
<th>Monitor I/O</th>
<th>Neutral</th>
<th>Monitor</th>
<th>Protective earth</th>
<th>Live 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td></td>
<td>C</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NC</td>
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The emLEDs to be connected in respective circuits are connected in series. There is a relay module, 98158, available (see page 395) which is connected in the circuit to facilitate adaptation to some monitoring systems or when a large number of emLEDs are to be connected to respective circuits. This has a true polarity-independent contact function, which is required by some monitoring systems. This can also be demanded by some I/O-modules based for example on LonWorks or EIB.

The relay module, which features status indications for voltage in and circuit faults, should be connected to an external voltage source of 24V DC and is designed for mounting on DIN-rails and has a 1-module width.
Corridors - evacuation routes
In a corridor with a ceiling height of 2.7 m, we have installed emLED-s. The spacing between the units is approximately 5 m.

The example shows that an illuminance of at least 1 lux is obtained on the corridor’s proposed centre line. Uniformity is also very good.

Open areas - anti-panic
Example of an anti-panic lighting system with an illuminance exceeding 0.5 lux. In this example we have installed 8 emLED-s units. The ceiling height is 3 m and there is about 5.5 m between the units.

The calculation example also shows that extremely good uniformity is obtained.

When lighting planning you can define a “wall zone” for the calculations (0.5 m) depending on shadows and obstacles in the form of book shelves, furniture, etc. You do not need to state any values in this zone, and the lighting level can be planned as low as 0 lux.
### Units

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<th>W</th>
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<td>emLED-s* with battery</td>
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<td>230-240V/50-60Hz</td>
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* Decentralised, i.e. with integrated battery that powers the light source in emergency mode. Equipped as standard with integrated self-test.

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### Accessories

<table>
<thead>
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<tbody>
<tr>
<td>Spare battery for 98150</td>
<td>98152</td>
</tr>
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<td>98158</td>
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### Design

**Degree of protection**: IP 43 (with permanent installation), protection class II. Plastic parts of PC/ABS plastic. Recess mounting clips of stainless steel. NiMH battery and green status diode (98150).

**Self-test**: 98150, emLED-s is equipped with an integrated self-test and potential free alarm contact for connection to a central monitoring system.

**Miscellaneous**

emLED withstands vibrations. Tests have been carried out by the Swedish Testing and Research Institute in Borås, Sweden. The product conforms to the requirements set out in IEC 60068-2-6 test FC and IEC 60068-2-64 test FV, which makes it suitable for installation in e.g. lifts. A separate brochure describing the emLED concept is available on request.

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**Installation**

Optional, either surface mounted or recess mounted in unventilated/ventilated areas.

**Connection**

Phase, neutral conductors and possibly a protective earth. emLED-s is also equipped with a 2-pole output designed for the connection of an external monitoring system. The output, which under normal operating conditions is made (NC), opens should a fault be discovered during the self-test. The output, which is controlled via an optoswitch, can be loaded with max 24V DC/50mA. All connections are collected in the luminaire body on a snap-in, 6-way terminal block. The detachable lower section housing the electronics and battery is connected where applicable to the terminal block in the luminaire body with a “plug in” connection. Through-wiring of 2.5 mm² cable possible (all positions). Cable entries fitted with blanking grommets on the top. Strain relief for movable cables with recess mounting supplied. Also prepared for a surface mounted mains cable.

---

**Open space for easy installation and a detachable lower section make emLED very service friendly.**
Regard for the environment and battery life

In emLED-s (with integrated battery) we have chosen to use a NiMH battery, this battery type is significantly more environmentally friendly than the more common NiCd type. In addition, NiCd batteries are subject to an environmental tax and within a few years will probably be banned.

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emLED-s, emLED-sc

"Stand-alone" version

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* Decentralised, i.e. with integrated battery that powers the light source in emergency mode. Equipped as standard with integrated self-test.

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Installation
Optional, either surface mounted or recess mounted in unventilated/ventilated areas.

Connection
Phase, neutral conductors and possibly a protective earth. emLED-s is also equipped with a 2-pole output designed for the connection of an external monitoring system. The output, which under normal operating conditions is made (NC), opens should a fault be discovered during the self-test. The output, which is controlled via an optoswitch, can be loaded with max 24V DC/50mA. All connections are collected in the luminaire body with a “plug-in” connection. Through-wiring of 2.5 mm² cable possible (all positions). Cable entries fitted with blanking grommets on the top. Strain relief for movable cables with recess mounting supplied. Also prepared for a surface mounted mains cable.

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The relay module, which features status indications for voltage in and circuit, faults, should be connected to an external voltage source of 24V DC and is designed for mounting on DIN-rails and has a 1-module width.

Open space for easy installation and a detachable lower section make emLED very service friendly.
exLED

- Connection to a terminal block housed in the luminaire’s fixed section.
- Connection to a terminal block with 1.5 mm² cable possible.
- exLED can also be wall mounted.
- Diodes indicate the luminaire status.
- Accessories kit for alarm output, potential free 90408

### Luminaire

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<thead>
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<th>Model</th>
<th>kg</th>
<th>V</th>
<th>W</th>
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</thead>
<tbody>
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<td>Decentralised with self-test and integrated battery (1 H)</td>
<td>0.7</td>
<td>230-240V/50-60Hz</td>
<td>1.5</td>
</tr>
<tr>
<td>Decentralised with self-test and integrated battery (3 H)</td>
<td>0.7</td>
<td>230-240V/50-60Hz</td>
<td>1.5</td>
</tr>
<tr>
<td>Centralised for centralised supply (1 H)</td>
<td>0.7</td>
<td>207-253V AC 50-60Hz</td>
<td>1.5</td>
</tr>
</tbody>
</table>

### Accessories

- Kit for alarm output, potential free 90408

**Installation**

- Detachable bracket for easy installation; surface or wall mounted.

**Connection**

- Cable entry from the front (1), from the rear (2), from the sides (1) or from above (2). 2-way terminal block.
- Through-wiring with 1.5 mm² cable possible.

**Design**

- The luminaire’s light source consists of 8 LEDs, which provide an energy efficient unit with balanced luminance. Body, bracket and diffuser of plastic (PC). Double sided design. The supplied signs (pictogram) for right, left and straight on, conform to ISO 3864.
- Maximum viewing distance 22 m (200 x sign height).
- Protection class II. Possible through-wiring of the protective earth cable is done in a separate top terminal.

**Self-test**

- Decentralised luminaire equipped with integrated self-test. Short test performed weekly. Long test including battery capacity check carried out quarterly.
- Tests can also be initiated manually.

**Louver**

- Illuminated signs.

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**exLED**

- Available in designs for both decentralised and centralised supply.
- Decentralised with integrated battery (NiMH) that powers the light sources in emergency mode.
- Potential free termination possible, see accessories.

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**Extrusion**

- 170
- 42
- 305